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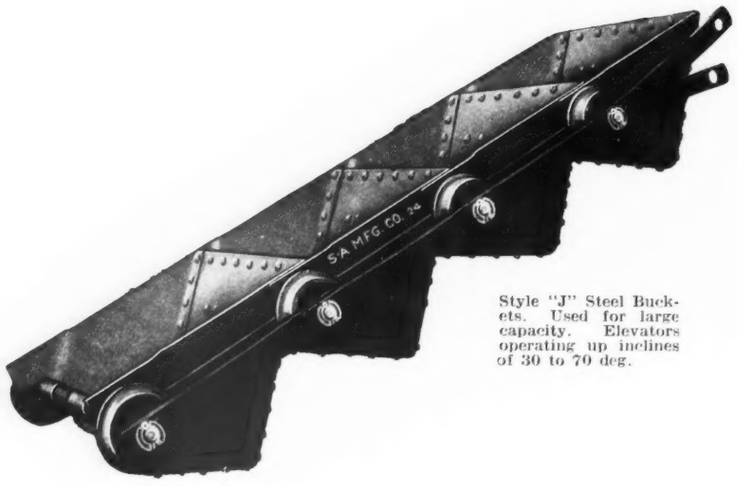

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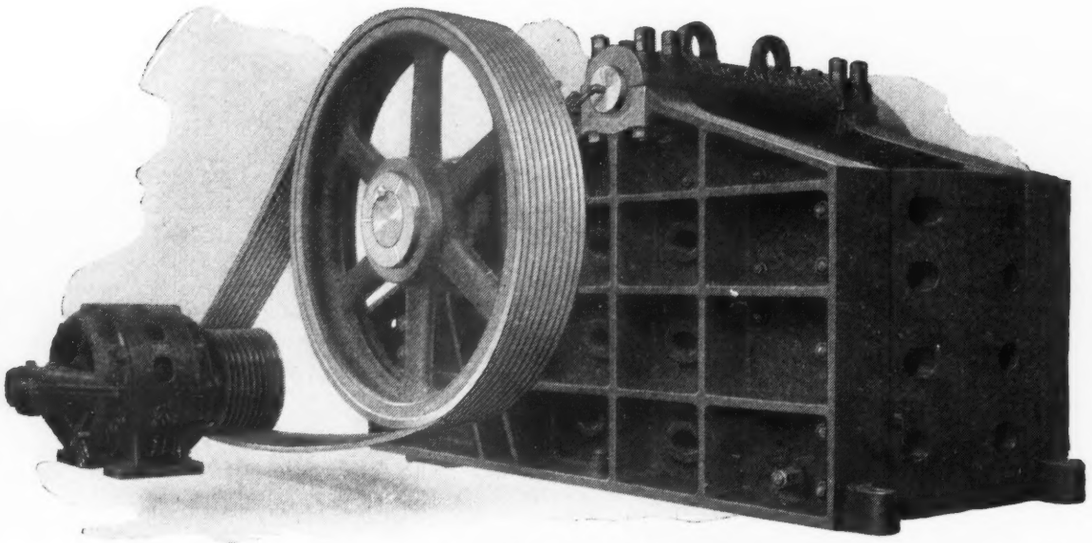

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Lead Production and Price

ONE MIGHT THINK that when lead prices are high, production also would be at a peak, and that if prices should drop 30 or 40 per cent, production would be adversely affected. That no such generalization can be made, however, is plainly evident from a cursory inspection of data for January, 1926, compared with those for August, 1927. The average price in the first month of last year was 9¼c. in New York and £34¾ in London; the decline of the last year and a half brought prices down to the August average of 6.681c. in New York and about £23¼ in London, a drop of 3c., or 31 per cent, in the United States, and £11½, or 33 per cent, abroad. But has this discouraged production? Perhaps it has discouraged the producers, but it has certainly not discouraged production, which has increased in almost every country, as the following table shows:

Tons of Lead Produced by Various Countries

	U. S.	Mexico	Australia	Mexico	Spain	Germany
Jan. 1926	50,796	16,401	13,391	16,401	10,602	6,868
Aug. 1927	56,423	22,918	16,110	22,918	8,925	8,000

These are the principal lead-producing countries, and each reports an important increase in production, save Spain (which includes Tunis), in which country most of the marginal producers seem to have been situated. Among the less important producers, increases are reported for Italy, Burma, and Rhodesia as well, Polish Silesia alone showing a decline.

The high prices of two years ago stimulated the search for and the development of new lead mines, which it took time to bring into production, and also had the effect of enlarging the capacity of the old properties, thus markedly increasing the lead-producing capacity of the world. Present prices are not yet low enough to put much of a brake on the utilization of this capacity, except in Spain and now, perhaps, in Australia, so production has gone on apace, regardless of consumption, and stocks in the United States and Mexico have built up from 105,000 tons at the beginning of 1926 to 170,000 tons on July 1, 1927. Stocks in other countries are unknown, but doubtless have increased similarly.

Thus the immediate future of lead prices is not particularly encouraging, but there is ground for hope in the world production figures for August, which show a decline from those of July, of 5,700 tons, or 3½ per cent, that prices may not drop much more. This is not much, but it indicates that the effect of present prices is more to limit output than to cause producers to operate at capacity in order to keep down overhead costs.

Six cents, or £22, may seem like a low price for lead judged by the recent past, but lead producers are not yet faced with the conditions that the copper producers have had to contend with for several years—prices at or below pre-war levels. Most lead producers are still making good profits, but world production must be curtailed further if even present prices are to be maintained. Production and consumption are perhaps nearly if not quite in step now, but the stocks of the metal should be reduced by a considerable amount to insure a reasonably firm market.

The New Mexican Ambassador

IT MUST give President Coolidge a great deal of satisfaction and pride to appoint a man like Dwight W. Morrow to be Ambassador to Mexico, for the appointment has so certainly been made as a result of the high esteem in which he holds the man, and without those political considerations which so often limit an executive's field of action. Mr. Morrow was a classmate of the President at Amherst, an old and trusted friend. He is a brilliant lawyer, business man, and executive, of the human variety. Though associated with the house of Morgan in New York for the last thirteen years, he stands for more than the aristocracy of wealth. He was selected by the Morgan firm for his financial ability and business acumen. He has made all the money that he wishes, and asks that his sons do likewise without any financial inheritance from him. Always interested in public service, he has now, apparently, at the age of fifty-four, decided to devote the remainder of his life to such work, severing all of his previous business connections so that he may be free to do so.

In Mexico, Mr. Morrow will have a real problem, which must be solved diplomatically and sympathetically. He will find a country that has been trying to find itself for sixteen years, in a period when the world has been in poor position to help. Many of its problems are not unlike those of the French Revolution, which, it may be remembered, was not accomplished in a day. In its effort to adjust the old wrongs of its people the Mexican government has not so far been conspicuously successful, nor has it always been wise or just in its foreign relations. American mining and oil companies have much just cause for complaint, but some of them have also, in their attempts to put over unscrupulous deals, fared as they deserved.

Mr. Morrow can, and we believe will, be more than a representative of the political and business interests of the United States in this most important, perhaps, of all diplomatic posts. Having become acquainted with the caliber of the man, the Mexican people may well come to regard him as a friendly counselor to Mexico as well, to the end that that country may soon emerge from its distracted condition and, with its great potential mineral and agricultural wealth, become a happy and prosperous nation.

Keeping Down the Scrap Supply

CORROSION has been called the enemy of industry. But to those who are engaged in mining and producing metals it is far less an enemy than a friend. It attacks their plant, their equipment, and their tools, but it also devours the metal and manufactured products that they sell, so that their customers must come back for more than they would otherwise require. How to prevent corrosion is one of the industrial problems of the day, but the longer this problem remains unsolved the longer the mining and metal industries have an agency working in their favor. It would be most improper for a metal man to seek to promote corrosion, but when sales are dull it is not unlikely that he may often wish that he could devise a way. At such times, rapid waste and no re-use may seem to him more desirable than that steel shall be stainless and last forever or that a metal roof shall need no repairs for a hundred years to come. His problem would appear to be to keep the customer coming back and not the metal.

What a boon it would be to this dealer in copper, lead, zinc, or other virgin metal if the secondary market could be made to disappear. But the campaign against corrosion works against him in this respect. With corrosion rampant, it might be expected that many a metal product would ultimately dissipate in rust. The same product, if made of non-corrosive metal, however, would be more liable ultimately to find its way back into the market to compete with primary metal.

For obvious reasons the scrap market is not susceptible of control. Scrap or junk finds its way back into industry through a thousand channels. Even in the case of virgin aluminum, the production of which, unlike the other major metals, is practically a monopoly, the puissant Aluminum Company of America cannot control the scrap market. But it nevertheless believes that the less scrap there is the better, and because of its monopoly is able to find a means of reducing the quantity of scrap that might otherwise compete with primary aluminum. By giving preference, whenever it can in manufacturing, to those products that are less likely to return as secondary metal, the company holds to a minimum the competition from scrap. Aluminum paint, for example, is viewed with kindly eyes, because it is popular with the public and it never returns to bother one; likewise the collapsible tube. Moreover, to the housewife aluminum means utensils, in which the company's line of manufactures is especially strong. Compared with glazed ware these have a long life, on the average lasting for years, so that the possibility of the scrapping of the metal in them to any great extent is not a matter of concern to the producing company at present.

Aluminum for motor cars is a different proposition. As a material for vehicles of all sorts it is ideal because of its lightness. Automobiles, however, are quickly scrapped, and the metal in them rapidly appears again upon the market. Therefore, it would not be surprising if the Aluminum Company were not particularly interested in sellling aluminum freely to motor-car manufacturers. As a matter of fact, it is said that some of the latter are satisfied as it is, inasmuch as they do not wish to become dependent upon a metal that might possibly be denied them if industrial conditions should develop unfavorably, or for other reason.

Producers of other metals should give more attention to this matter, if they would serve their own interest better. In seeking new uses for their products they would do well to give the preference to those that are most destructive of the copper, lead, or zinc. Conservationists will decry this doctrine; but, for that matter, immortality is not for metals.

In Quest of a Meteor

ANOTHER ATTEMPT is to be made to locate the meteor that some believe was the cause of the large crater near Winslow, Ariz., and now lies buried beneath the surface. This belief amounts to a conviction on the part of the owners of the property, for the crater presents the appearance of having been caused by a huge projectile, and fragments of meteoric substance have been found about its rim; and, strongest evidence of all, material thought to be meteoric has also been found at a depth of over 1,300 ft., through boring. Further boring is thought impracticable, owing to the nature of the ground. The search must be continued through shafts and drifts. If, indeed, the material found be meteoric, there can be little question as to the origin of the crater.

The enterprise therefore has a romantic flavor. Some years ago a large company spent considerable money in quest of the supposed meteor, and, because of the very air of romance in which the project was enveloped, those concerned were much averse to publicity regarding it. Romantic or not, the venture has a business aspect, for it is not unlikely that the meteoric material would be commercially valuable for its metal content if found in sufficient quantity. Samples from the bore hole mentioned were "50 per-cent iron, magnetic, carrying nickel." Practically all iron meteorites have been found to be a natural alloy of iron and nickel, containing 5 to 8 per cent of the latter metal. Some of those found on the surface in the vicinity of Meteor Crater, as it is called, near Winslow, have also shown one assay to contain appreciable percentages of platinum and iridium. Thus there is the possibility of a prize to be won that whets the appetite for the search.

The hunt for this winged orebody, which is supposed to have come to rest at Winslow, is nevertheless a prospecting venture, for the existence of the "ore" cannot be considered to have been proved up to the present time.

The Empire Congress and Mine Financing

THE second triennial Empire Mining and Metallurgical Congress nears an end, and it has evidently been a great success. The operators in Canada have shown off their country and what they are doing in the development of its mineral resources, and from the visitors they have learned much of what is being done in other parts of the world. Those on the trip have obtained first-hand information that will, in many instances, be of much importance to them in the time to come, and have evidently been entertained royally. Everyone connected with the project, as host or guest, has formed new and valuable friendships as well as business and professional contacts.

In London, the Congress is the subject of much comment among those who remained at home, as is related

on another page of this issue. The subject of increased support for Canadian mining development naturally comes up in that financial center, and the greater familiarity of the touring members of the Congress with Canadian mining and mining engineers should assure more financial backing from the mother country than has yet been forthcoming. This subject was not one of the avowed aims of the Congress, but political speakers plainly emphasized it in the addresses given in the East some weeks ago.

The Englishman is inclined to look askance at the Canadian method of financing, wherein, he thinks, too much of the money goes to the broker and too little to the development of the mine. It is precisely from this, however, that the holder of a mining claim in Canada would like to escape. He does not give the broker a quarter or a half of the proceeds of the stock sale because he wants to, but because he can raise money in no other way. The claim owners would like nothing better than to deal direct with individuals with money, or with companies looking for meritorious properties to develop, and not engaged in a brokerage business. They would like, for example, to finance their properties as the Wright-Hargreaves was financed, by a small group of men, with no stock put on the market until the mine was a proved success. Noranda is another good example. Development of this property was a private enterprise, and it was long after an enormous tonnage of ore was developed that the general public had a chance to buy its shares.

Buying of shares in a mining company usually helps mining development only indirectly. What is desired is money to be applied directly to the finding of ore and production of concentrates.

An Echo of Weepah's Boom

WEEPAH has not passed out of existence. No, indeed! The spotlight in the last few weeks has merely been turned on something else. Weepah may still be found amid the Nevada sagebrush, and likewise, as its center and principal reason for existence, the operations of Electric Gold. It was this company's discovery of a limited amount of high-grade ore that was the cause of the recent but now almost forgotten boom. To revive interest in the venture a New York broker has just issued a rush bulletin on the company's stock. Naturally this circular contains immensely important news. It whispers out loud that the press has stated that officers of a certain mining corporation are negotiating for a block of Electric Gold Mines shares. Investors should get in before the price goes up, it says. They now have their last chance to buy at the low price of 75c. a share. "It is slipping away from you!" the bulletin reads. Further, prospective "investors" are urged to "Plunge to the limit and make the killing of a lifetime."

Such high-pressure selling methods are justified, some hold, for otherwise it is difficult, in their opinion, to raise money for mining purposes. Extravagance of statement will lower sales resistance, they say, where prospective customers are lacking in intelligence. It is the least intelligent who are most likely to be impressed by flamboyant circulars. Therefore, since the unintelligent form the wide majority, the sales appeals should be addressed to them and in a flamboyant manner.

Thus runs the reasoning to which unfortunately far too many seem prone to subscribe today. But it is the reasoning of a dishonest man. It seeks to justify the procuring of money through deception. It is difficult to imagine a reputable company or individual sending out such literature.

The mining company that has honest and worthy intentions toward its stockholders is not likely to approve of dubious selling methods. Often, however, it is powerless to stop them without injuring itself. As for Weepah and Weepah stocks, the public will be wise if it waits, before it gets excited, until the camp can show a really notable discovery.

Better Business Expected in the Coming Season

BUSINESS CONDITIONS in the United States at the beginning of the fall season are surprisingly good, according to the economic reports that are so freely published, and metal producers may well be encouraged at the prospects for the next few months. An improvement in the prices of most commodities has been the outstanding business development of recent weeks, and as these had been receding for the last two years with no major interruption, the reversal of the trend is of importance. Metal prices have not yet been outstanding examples of an upward trend, but there seems no reason why, as a class, they should be exceptions. The low level of interest rates may be expected to make for larger production in the industrial plants of the country and to encourage new investment in plant and equipment, all of which will require a larger quantity of metal than has been used in recent months.

Two major sources that afford an outlet for metals that have been unexpectedly weak are the wire and cable business, and storage-battery manufacture. More industrial activity should require more power, telephone, and telegraph lines, and cheap money will facilitate their erection. In the battery business, resumption of operations by the Ford company this fall should be an activating influence.

Metal producers must, however, look to the economic condition of the principal foreign countries as well as of the United States. British industrial activity slackened more than usual during the summer, and no marked improvement is predicted for the coming months. Conditions are better in France, where the economic recovery is continuing, but perhaps the greatest encouragement for metal producers comes from Germany, whose industrial recovery is startling. That country now takes more than 16,000 metric tons of copper a month, equivalent to about 40 per cent of the total exports of the United States; 20,000 metric tons per month of lead, or a third of all that produced by United States smelters; and Germany, though an important zinc-producing country, is importing about 9,000 metric tons a month, or about a fifth of the United States production.

All in all, it is likely that consumption of metals will be excellent throughout the world in the next few months; in fact, better than was generally expected. Prices should also take a turn for the better if production is adjusted to requirements; in fact, an improved tone in the prices of most of the metals is now evident compared with the first of July. Lead, however, seems urgently to require a cut in production before much can be expected in the way of improved prices, as is more fully discussed in the leading editorial on page 521.

Montana's Manganese *and the* Tariff

By Albert J. Seligman
President
Butte Copper and Zinc Co.

ALBERT J. SELIGMAN

THE American manganese industry is still in its infancy and if properly fostered by the United States Government will in a time of need repay a thousand-fold the egis of protection thrown around it. A number of possibly well-meaning but certainly badly informed people have tried to show that not merely is there no large tonnage of manganese ore available in the United States but that there is also no possibility of the existence of large resources here which can be developed. The utter fallacy of this can be proven by our experiences in Montana. I venture that there are millions of tons of manganese ore in the Butte and Philipsburg districts alone which can be rapidly developed. Speaking for the Butte Copper & Zinc Co., of which I am president, I can state that we have shipped to date more than 250,000 tons of manganese ores averaging between 37 and 40 per cent manganese, the bulk of which was extracted in two years. Our ore, which is rhodochrosite, a carbonate which lends itself readily to treatment, has been used in large quantities by the United States Steel Corporation, by the Lavinos, and by a number of Chicago furnaces, and, we understand, has given general satisfaction.

During the World War, at the request of the government, we concentrated on manganese production and at the time of the armistice had reached an average output of 500 tons a day. Had we not been prevented by lack of hoisting facilities and of storage space on the surface, we could have shipped 1,000 tons a day. Since then our company has bought the Ophir claim. The collar of the Ophir shaft is at the railroad level, and by connecting our lower levels with this shaft we could in a short time, if called upon, hoist 1,000 tons of manganese ore daily. Our reserves of this ore are large, and it is found on our lowest levels. The Clark mines adjoining also show large bodies of the rhodochrosite ore and should be able to produce a heavy tonnage when required. The Philipsburg properties have extremely large deposits of pyrolusite, a manganese oxide, and their production can be speeded up whenever conditions warrant.

Advocates of the reduction or repeal of the present tariff point out that in spite of the tariff manganese production has fallen off and that the protection therefore might as well be removed. Speaking for our company we have been anxious to ship our manganese, but until recently could find no market for it. Even at the present low prices for the ore we can operate at a small profit with the tariff. During the last year we have succeeded in attempts to raise the grade of our product from 38 to 56 per cent manganese by nodulizing it. Thus we can now make a saving on the gross freight rates, and thereby operate more advantageously.

Some weeks ago we closed a five-year contract with the Domestic Manganese & Development Co., giving that company an option on our entire manganese output in addition to the amount fixed in the contract. This should run from 350,000 to 500,000 tons during the five-year period. We understand that other contracts have been made by this company with other producers in the immediate vicinity, so that this one plant alone should be able to furnish a fair proportion of America's manganese requirements. Should the tariff be removed, it is certain that the plant would have to be shut down. I doubt if any manganese mine in America would be able to operate without it. I am sure that the Butte Copper & Zinc Co. could not, and I believe that our company can keep our mining expenses as low as any others, if not lower.

In Minnesota, furthermore, with the iron ores there an incalculable amount of manganese occurs, ranging from 2 and 5 per cent up to 10 and 18 per cent, and I am informed that Mr. Wilson Bradley is putting up a large plant for the treatment of these ores. This project, together with that of the Domestic Manganese company, should eventually yield nearly 50 per cent of the manganese ore requirements of America.

I SINCERELY trust that the policy of our government will not be to throttle this important and growing industry. I am convinced that when the members of the Tariff Commission shall have visited the manganese mines and reported on the manganese resources that they have seen with their own eyes, the policy of the government will be to foster it in every way possible and thus insure a production which at all times will be a protection to the country.

A Simplified Solution of Ventilation Problems of Hot Mines

By Robert A. Elgin
242 Middlefield Road, Palo Alto, Calif.

THAT mine operators should know the effect of high atmospheric temperatures upon the working efficiency of the miner is of considerable importance. High atmospheric temperatures greatly lower working efficiency, as was shown by Orenstein and Ireland[1] in South Africa. Kata thermometers were used to determine the condition of the underground atmosphere and ergometers to determine the working efficiency of employees. The experiments showed that with a working efficiency assumed as 100 per cent in air with a cooling power of six millicalories per square centimeter per second, efficiency dropped to 50 per cent in air with a cooling power of one millicalory per square centimeter per second. These experiments indicate the importance of controlling atmospheric temperatures in underground workings.

Experiments conducted in a California gold mine showed that the air in one particular stope had a cooling power of only two and four-tenths millicalories per square centimeter per second with a wet- and dry-bulb temperature of 81.5 deg. F. Based on the experiments of Orenstein and Ireland, the possible working efficiency was only 64 per cent. The temperature of the rock in the stope was 82 deg. F., which is not very high, so it can readily be seen that a rock temperature of 90 deg. F. or more that is encountered in many mines would make work economically impossible under such conditions.

The human body must maintain an even temperature of 97 to 98 deg. F. in order that work may be done at all. In dry air at a temperature below 97 deg. F., cooling of the body takes place directly into the air by radiation, and indirectly by conduction into the film of water on the surface of the body. The water film, formed by sweat, is cooled by the heat-absorbing power of water in vaporizing and a subsequent loss of the water vapor by diffusion. If the temperature of dry air is above 97 deg. F., cooling of the body can take place only by conduction into the water film, with subsequent diffusion of the vapor into the air; and in saturated air at the body temperature both the wet- and dry-bulb temperatures are at the body temperature and there can be no cooling of the body whatever.

Weeks[2] states that "The limiting wet-bulb temperature that can be endured in still air was found by Haldane to be 88 deg. F. In still air at 78 deg. F. wet-bulb temperature hard work is impossible." The question naturally arises as to what air movement, temperature and humidity should prevail if satisfactory working conditions are to be obtained. Mitke[3] gives as standard working conditions an air temperature of 78 deg. F., a relative humidity of 80 per cent, a velocity of 125 ft. per minute, and a volume of 350 cu.ft. per man per minute.

In hot, deep mines, the chief factor contributing to uncomfortable and inefficient conditions is the heat radiated from the mine rock. Nevertheless, few mining engineers have attempted to calculate the volume of air necessary to care for this source of heat. Temperature gradients range from 1 deg. F. for every 60 ft. of depth up to 1 deg. F. for every 200 ft. of depth in the mining districts of the world. For the majority of mines there exists a temperature gradient of 1 deg. F. for approximately every 125 ft. of depth.

Quantity of Radiated Heat to Be Absorbed

In designing a system of ventilation for a given mine, it is desirable that the quantity of heat radiated into the ventilating current and the volume of air necessary to care for this amount of heat be known. Clifford[4] attempted the solution of this problem in designing the ventilation system of the City Deep mine, in South Africa, but other engineers have been slow to follow his lead. Undoubtedly the reason Clifford's solution of the problem has not met with its merited recognition is that a number of factors were introduced with which the mining engineer is unacquainted. Also, a request was made by a number of eminent scientists in the mining profession that Clifford give an explanation of the formula he used, and show how it was derived; but, so far as is known, this has never been done.

Clifford presents the following problem:

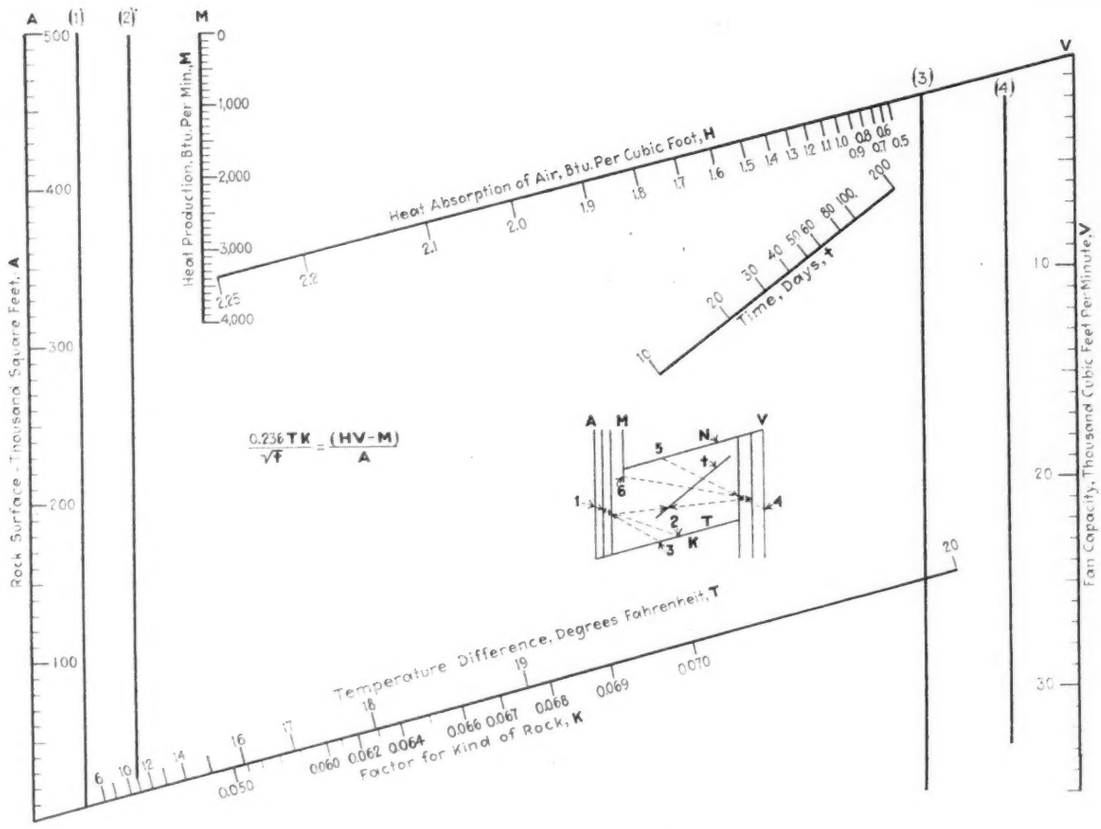
Mean surface temperature of air = 15.3 deg. C.
Relative humidity = 56 per cent
Standard underground temperature = 22 deg. C.
Area rock surface exposed = 1.25×10^{19} sq.cm.

Density of rock..... d = 2.68
Conductivity ..... k = 0.0093 cal./cm. cub./degree C.
Specific heat ..... s = 0.19 cal./gm./degree C.

Thermal diffusivity..... $K = \frac{k}{ds} = 0.0182$

Production of heat in the mines by men, explosives, and electric power = 185,000 cal./sec.
Heat absorbing power of air on heating from 15.3 deg. C. to 22 deg. C. on account of evaporation = 6,000 cal./cub.m.
Volume of air circulated = 200 cub.m. per second
Cooling will therefore be 6,900 × 200 = 1,380,000 cal./sec. less 185,000 cal. (men, explosives, etc.) = 1,195,000 cal./sec.

[1]Orenstein, A. J., and Ireland, H. J.: "A Contribution to the Study of the Influence of Mine Atmospheric Conditions on Fatigue." *Journal* of the South African Institute of Engineers, March, 1921, p. 126.
[2]Weeks, W. S.: "Ventilation of Mines." McGraw-Hill Book Co. P. 170.
[3]Mitke, C. A.: "Metal Mine Ventilation in the Southwest." *Trans.* A.I.M.E., Vol. 68, 1923, p. 377.
[4]Clifford, E. H.: "Scheme for Working the City Deep Mine at a Depth of 7,000 Feet." *Trans.* Institution of Mining and Metallurgy, London, p. 243, 1920-1921.



Nomograph for mine ventilation

Distributed over the whole rock surface this would set up a current of heat $= \frac{1,195,000}{1.25 \times 10^{10}} = 9.6 \times 10^{-5}$ cal./sq.cm./sec.

Therefore there will be a temperature gradient at the surface of the rock of $\frac{9.6 \times 10^{-5}}{0.0093} = 0.0103$ deg./cm.

Treating the mine as an infinite mass of rock bounded by a flat surface kept from a certain date onwards at a fixed lower temperature and taking

θ_0 = temperature of air.
θ_1 = temperature of rock.
T = time after starting to keep cool.

$$K = \frac{k}{ds} \text{ (thermal diffusivity)}$$

the temperature gradient close to the surface after any interval T will be

$$\frac{\theta_0 - \theta_1}{\sqrt{\pi K T}}$$

In the present case the temperature of the rock is, say, 26.4 deg. C. and it is desired to keep the air at 22 deg. C. The temperature gradient near the surface of this rock T sec. after the cooling process has been commenced will be

$$\frac{4.4}{\sqrt{\pi \times 0.0182 \times T}}$$

On equating this to the temperature gradient set up by the air current, T is found to be about thirty-nine days; that is to say, in this time the surface of the rock will have a mean temperature of 22 deg. C.

Examination of the equation given by Clifford shows that it was derived from Fourier's equation for the linear flow of heat in an infinite solid at a constant temperature.[5]

Not only are the units used in this solution awkward for the American engineer, but the formula requires that the volume of air circulated be known. At the same time, few mining engineers are in a position to know the conductivity, specific heat, density, and thermal diffusivity of the rock in any particular mine.

Conversion of Formula

The formula expressed in English units with a simplified expression for thermal diffusivity is believed to be of general interest to mining engineers. It may be criticised upon the ground that it is based upon the linear flow of heat from a flat surface, whereas mine workings are more or less oval in shape and would seem to introduce radial heat flow. However, it would seem that this error is of theoretical importance only, for it is known that the cooling of mine rock extends only a few inches beyond the surface during a period of many years. It is common practice to consider the cooling of a thin shell the same as the cooling of a flat surface, so the formula is well within the limits of observational error.

It is found that the factors conductivity, density, and specific heat can be combined in such a way that use may be made of them by the mining engineer without exhaustive tests being conducted. If conductivity, specific heat, and density of the rock are represented by the letters k, c, ρ respectively, and let $K = \sqrt{kc\rho_K}$, a factor may be used that will apply to the majority of mine rocks. The following values for K may be used:

Limestone	0.0520
Average of earth crust	0.0560
Granite	0.6490
Quartz	0.0690

K is found to increase with the percentage of silica in the rock, and, also, to some extent with degree

[5] Ingersol, L. R., and Zobel, O. J.: "Mathematical Theory of Heat Conduction." Ginn & Co. P. 80.

of crystallization. Where the factors are known for any particular mine, K may be determined exactly. Expressed in English units and making use of K, Clifford's formula becomes:

$$\frac{0.236TK}{t^{\frac{1}{2}}} = \frac{(HV - M)}{A}$$

The factors used are as follows:

T = Temperature difference between rock and air, in degrees F.
K = Factor for kind of rock.
t = Time for surface of rock to cool approximately to air temperature, in days.
H = Cooling power of the air, in B.t.u. per cubic foot.
V = Volume of air circulated through the mine, in cubic feet per minute.
M = Heat production in the mine from other sources than the rock, in B.t.u. per minute.
A = Area of exposed rock surface, in square feet.

To simplify the solutions of problems, the foregoing formula has been expressed in the form of a nomograph.[6] The scaling on the nomograph may be used as shown, or all the vertical scales may be multiplied by a factor to bring them within the limits of any particular problem. The values of the sloping scales remain unchanged under all such conditions.

Use of Nomograph Chart

The chart may be used either to find the volume of air necessary to cool the rock surface to a standard temperature in a given number of days, or, with the volume of air given, the time required to attain a standard atmospheric temperature may be determined.

As an example of the use of the chart, the problem of the City Deep mine is solved as follows:

Let

V = 420,000 cu.ft.	M = 44,000 B.t.u. per minute
T = 8 deg. F.	A = 12,830,000 sq.ft.
H = 0.777 B.t.u. per cubic foot	K = 0.069

Find "t," the number of days it will take the air to cool the surface of the rock to a working temperature. In other words, find the number of days before the heat input to the air will be exactly equal to the heat-extracting power of the air.

To fit the data to the scale conveniently, divide V, M, and A by 40. This will not affect the answer in any way. We then have $V = 10{,}500$; $M = 1{,}100$; $A = 320{,}000$.

Place one end of a straight-edge on the scale "A" at 320,750; place the other end on scale "T" at 8, and mark the intersection on axis "1." Connect the point on axis "1" with point 0.069 on scale "K," and mark the intersection on axis "2." On the right-hand side of the chart connect the point on the scale "H" at 0.777 with the point 10,500 on scale "V," and mark the intersection on axis "3." Connect the point on axis "3" with the point 1,100 on scale "M," and mark the intersection on axis "4." The line connecting the point on axis "4" with the point on axis "2" will intersect scale "t" at 43, which is the required time to cool the surface of the rock to the standard temperature.

If the time is assumed and it is desired to find the volume of air necessary to satisfy the given conditions, proceed as before to the point on axis "2." Place a straight-edge on this point and on scale "t," and mark intersection on axis "4." Connect this point with scale "M" and mark intersection on axis "3." A line connecting the point on axis "3" with a point on scale "H" will intersect scale "V" when projected. The value read on scale "V" is the required volume of air in cubic feet per minute.

For convenience in reference, some data will be given as to the heat generated by other sources than the mine rock. Richardson[7] considers that the oxidation of 100,000,000 board-feet of timber at the Butte mines is the greatest source of heat developed. The heat of oxidation of mine timber has received consideration as a matter of importance by the U. S. Bureau of Mines, but it has been found impossible up to the present to conduct quantitative experiments. It is not known that anyone has yet solved the problem. In heavily timbered mines, the heat generated by the oxidation and decay of timber can best be determined by actual observation. The heat generated by sulphide minerals will depend upon the kind of sulphide, the degree of crushing, the temperature of the rock, and the quality of the air.

Mechanical equipment will give out an amount of heat represented by the energy input minus the energy produced in useful work. With an estimate of 150 grams of carbide used per man per shift, the heat generated by miners' lamps will be 11 calories per second. Weeks[8] gives the heat production of a miner at work at 250 kg.cal. per hour, and resting as 70 kg.cal. per hour. It is reasonable to estimate an average heat production of 57 cal. per man per second. Draft animals produce about five times the heat of a man; so it may be assumed that each animal produces 275 cal. per second while working and 95 cal. per second while resting. It is estimated that the heat generated by exploding 100 grams of 40 per cent gelatin amounts to 1,165 calories.[9]

World Is Over-Supplied With Bismuth

A REPORT on the Bolivian bismuth ore deposits, which for over fifty years have dominated the market, was published recently in *Metall und Erz*. It states that the deposits are so considerable that production could be multiplied several times if necessary. They are confined, however, to the tin-producing province of the Eastern Cordillera and include the following: Hucumarini, Carmen-Aurora, Uncia-Llallague, San Pedro, Tasna, Chorolque, and Esmoraca. The richest are situated in the isolated mountains of Ubina, Tasna, and Chorolque. The selling association under the leadership of the Aramayo concern has long controlled the price of bismuth.

World consumption has latterly risen and is now given as 270 tons annually. Tasna, however, alone can produce one ton of bismuth daily. The crisis which developed on account of overproduction in 1923 is still in evidence, despite the understanding reached between the Aramayo and Patiño interests. The present stock of bismuth metal in Europe belonging to the two chief producers is reckoned at 460 tons—sufficient for two years' world consumption. At the end of 1926 the Aramayo group suspended production at Tasna and Llallagua reduced output. It would seem, continues our contemporary, that until fresh outlets are found for the metal, it will be impossible for the rich Bolivian mines of Livichuco and San Pedro to be developed.

[6] The nomograph was designed by C. A. Kulman, of Stanford University.

[7] Richardson, A. S.: "Ventilation of the Butte Mines of the Anaconda Copper Mining Co." *Trans.* A.I.M.E., Vol. 68, 1923, p. 33.
[8] Weeks, W. S.: "Ventilation of Mines." P. 168.
[9] Hall, Clarence, and Howell, Spencer: "Selection of Explosives Used in Mining Operations." U. S. Bureau of Mines Bull. 48, p. 47.

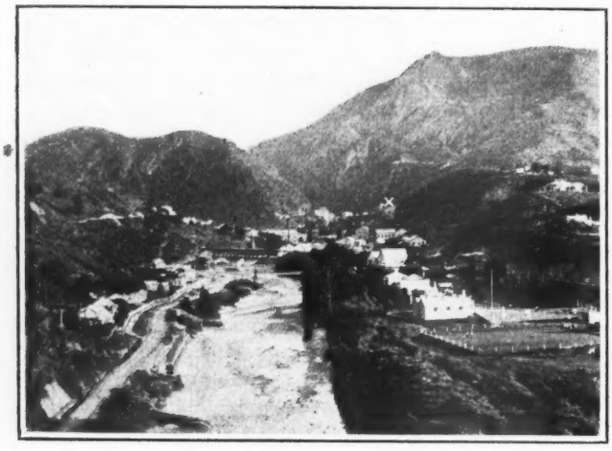
Early History of the Cyanide Process

SECOND PART*

Its First Commercial Application in New Zealand, South Africa and in the United States

By A. W. ALLEN

COMMERCIAL APPLICATION of the cyanide process was first accomplished at Karangahake, Auckland Province, New Zealand, on the property of the Crown Mines Company, a Glasgow corporation, early in 1889. The first ore treated came from the Maria lode of the Woodstock mine, at which J. McCombie was general manager; it was dried, finely ground, and agitated in a vat with a solution of cyanide—0.5 per cent



Karangahake, on the Ohinemuri River, New Zealand, with mill of the Crown Mines Co., where the first commercial cyanide plant in the world was erected and operated

KCN—the so-called liquor being removed subsequently by treatment of the pulp in a plate-and-frame filter press. Zinc shavings, packed in vertical boxes or "towers," served for precipitation purposes. The recovery of gold was reported to have been about 89.2 per cent from an ore assaying about 1 oz. per ton. It is interesting to note, therefore, that the first cyanide plant in the world was designed for all-sliming treatment, and that filter presses were used for the separation of solution from residue. It is also significant that the Karangahake plant operated on untreated ore, not on the tailing from an amalgamation mill.

The technicians responsible for laying this foundation comprised J. McConnell, in charge; F. Smeaton, and J. Tegart, all of whom came from Glasgow. The plant was subsequently superseded by one of larger size and improved mechanical features, designed for the separate treatment of sand and slime, the former being leached, by upward percolation it is said, in vats that measured 11 by 9 by 3 ft. deep, the slime being agitated and filter-pressed. The extraction averaged 93 per cent of the gold and 79 per cent of the silver. In the meantime, in 1891, Alfred James had been sent to New Zealand to introduce the process on an ambitious scale. At this time the Waihi Gold Mining Co. was indebted to a local bank to the extent of about £5,000. The company owning the cyanide patents, through its representative, offered to pay the overdraft on condition that the Waihi tailing dump, the residue from pan amalgamation processes, was put at its disposal. The consummation of this plan proved highly profitable for the patentees, and marked the turning point in the financial history of a gold mine which, thanks largely to the successful application of the cyanide process, was subsequently recognized as one of the greatest in the world. F. R. W. Daw was responsible for the introduction of the now well-known method of crushing gold ore in cyanide solution, in stamp batteries on a large scale, at the Crown mine plant in 1897. "The Cyanide Process," a textbook by James Park, director of the Thames School of Mines, New Zealand, published in 1900, was one of the earliest technical treatises on the subject. Rights to use the cyanide process in New Zealand were sold to the government in 1898 for a sum variously reported at £10,000 or £15,000. The Crown Mines company paid no royalties because of other arrangements resulting from an affiliation with the MacArthur-Forrest company.

Roasting in subsequent New Zealand practice facilitated the leaching of the entire mass, with excellent technical results. Cost was the sole drawback, if the unhygienic conditions prevailing could be overlooked. At the Waikino plant of the Waihi company the dry-crushed ore was introduced into rectangular concrete vats, through canvas tubes that were supplied from overhead conveyors. Shallow depths of charge were usual, about 2 ft. 6 in.; and a vacuum was utilized to assist drainage. About that time, prior to 1900, the treatment of slime, as such, presented considerable difficulties, but bulk leaching was found practicable with an ore containing no refractory mineral. Later, however, when sulphides were mined, wet crushing was adopted, the stamp mills being modified accordingly. The change from dry to wet

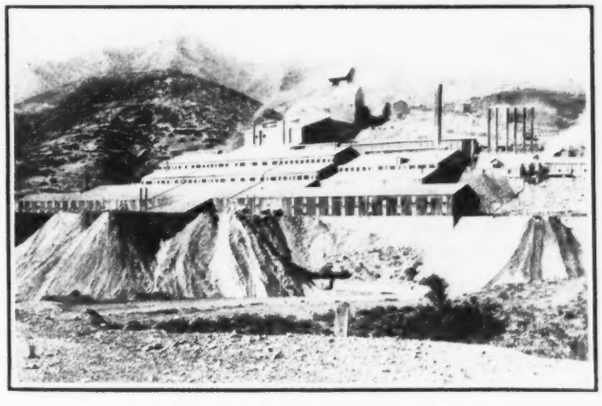
*The first article of this series appeared in the Sept. 3 issue of *Engineering and Mining Journal*. It is intended, after revision, to republish the history in booklet form. Readers who have suggestions to offer or corrections to make are invited to communicate with the Editor.

crushing was a comparatively slow one, in conformity with changing conditions in each mine, but by 1900 the latter method was standard practice.

A separation of sand and slime was made in pointed boxes, each product being cyanided separately. In some instances a concentrate was also made, which was cyanided; the simultaneous grinding and cyaniding of concentrate was practiced in 1901, pans being used, as in Western Australia. The sand pulp was distributed in some of the early New Zealand plants by means of wooden revolving launders, somewhat similar to those used in the modern Dorr agitator. This was previous to the use of the Butters-Mein distributor. The slime was agitated mechanically and the solution was decanted. Precipitation on zinc shavings followed normal practice. Among those who were prominent in the development of cyaniding in New Zealand was H. P. Barry, who was responsible for the method of central washing in filter presses and for several other useful innovations; he was superintendent for the Waihi company. F. C. Brown was the inventor of the air-lift vat bearing his name, first tried at Komata, New Zealand, in 1902, which proved so successful at Pachuca, Mexico, that it was thereafter known as the Pachuca agitator. It is also interesting to recall that the difficulty in preventing the settlement and packing of slime in a flat-bottomed vat during decantation led to the introduction in 1902 at the Waikino mill of the Waihi company of a slow-moving agitator, by the use of which the decanting zone was not disturbed.

South African Operations

In South Africa the opposition to the introduction of the cyanide process was overcome by persistent effort. Alfred James, identified with its successful application on a large scale, author of "Cyanide Practice," 1901, was sent there in 1888 and made a reconnaissance for the Cassel Gold Extraction Co., for which MacArthur was technical manager in Glasgow. On a second visit, in 1890, he (James) erected a demonstration plant alongside the mill of the Salisbury Gold Mining Co., near Johannesburg. The material was treated in 1½-ton agitation vats equipped with stirring gear, then discharged into leach-filter vats placed below. The strength of the solution used varied from 0.5 to 2 per cent KCN, and an extraction of from 75 to 87 per cent was obtained. The success of this plant, in which were first treated parcels of pyritic and free-milling concentrates from the Crown Reef and Meyer & Charlton properties, led to plans being drawn for a large leaching unit—40-ton vats—to handle the amalgamation tailing from the mill of the Robinson Gold Mining Co., in the central portion of the Witwatersrand, in connection with which the name of G. A. Darling is honorably associated. The initial tests were made at the Salisbury demonstration unit late in 1890. The Robinson plant, which started operations at a capacity of 120 tons per day in December of that year, was the forerunner of standard practice in South Africa. Square leaching vats, 20 by 18½ by 3¾ ft., were used, made of 9 by 3 in. wooden planking, this shape being adopted to insure prompt erection and to enable the syndicate to act on an option obtained from the Robinson company. The initial outlay was £3,000, and a profit at the rate of £2,000 per month was made after only a few weeks of operation.



Golden Gate, Mercur, 1900

"CYANIDE IS KING."

NEW MINING ERA.

OLD AND ABANDONED MINES CAN BE PROFITABLY WORKED

BY THE

MacArthur-Forrest Process

CONTROLLED BY

THE GOLD AND SILVER EXTRACTION MINING AND MILLING CO.

CAPITAL STOCK, $5,000,000 — 50,000 Shares, Par Value $100 Each; Full Paid and Non-Assessable.

THE MOST WONDERFUL PROCESS EVER DISCOVERED.

CHEAP, SIMPLE, EFFECTIVE. TITLE PERFECT—PROTECTION GUARANTEED.

HUNDREDS OF TESTIMONIAL LETTERS ON FILE.

MILLS IN OPERATION AS FOLLOWS, VIZ:

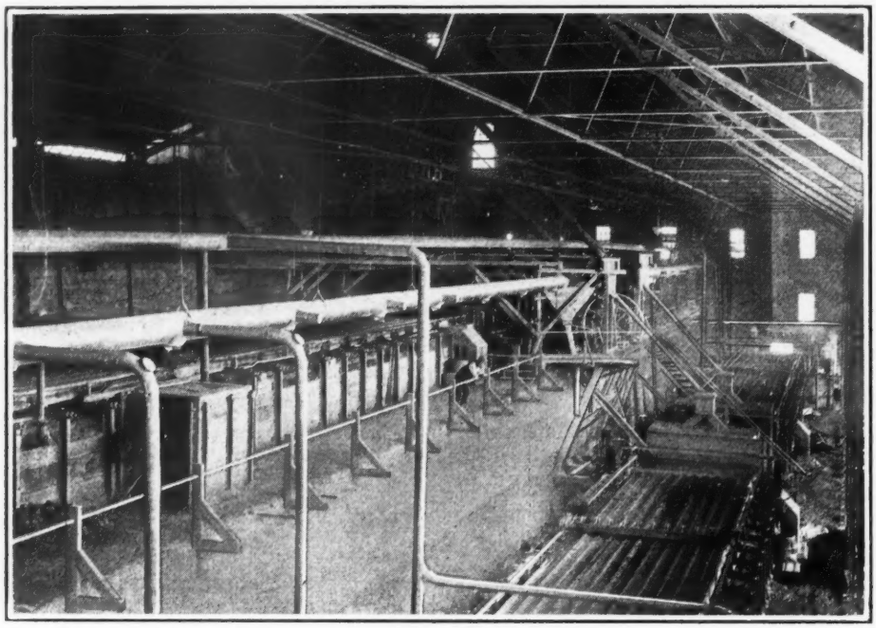
THE OBJECT OF THIS COMPANY IS TO INTRODUCE THE MacARTHUR-FORREST PROCESS.

Address T. L. WISWALL, General Manager and Secretary

Announcing the cyanide process in the United States. An advertisement that appeared in the "Mining and Scientific Press" of July 2, 1892

A combined cyanidation-chlorination treatment was a feature of subsequent operations (1892) at the Robinson mine, the plant being designed by Charles Butters, assistant to Hennen Jennings, both of whom were in Johannesburg when the cyanide process was first introduced by James and MacArthur. The gold-bearing pyrite was treated on Frue vanners, the concentrate going to chlorination and the tailing to cyaniding. Butters, who was also responsible for the introduction of the bottom-discharge leaching vat, was succeeded by W. W. Mein in the management of this plant, the name of both of these engineers being associated with the well-known distributor for the delivery of a sand-slime pulp in a collecting vat. A few years later, consequent on the developments that occurred in the technology and engineering of the cyanide process, chlorination was dis-

pensed with. The continuous cyanide treatment of tailing direct from the battery was initiated by Hennen Jennings at the Salisbury mill in 1893. The vats were square, however, and difficulties arose in the practical application of the idea. Success was later achieved at the Nigel and New Herriot plants by the adoption of the Butters-Mein distributor in circular vats. It is of interest to note that the use of the lead-zinc couple in the precipitation phase of the process, patented by MacArthur in the early 'nineties, was originally devised for improving the precipitation of gold from cupriferous cyanide solutions resulting from the treatment of refractory ore in the Pilgrim's Rest district of the Transvaal; but its more general use later enabled extremely weak cyanide solutions to be employed in the application of the process on normal material.



Calcining furnaces, Golden Gate mill

A significant mechanical development, in 1897, was the separate settlement of slime in vats, instead of in dams, whereby a clean overflow was available for return to the battery, and considerable economies in water consumption were effected. John R. Williams was responsible for the introduction of the large vats of brick, faced with concrete, 40 ft. diameter and 10 ft. deep, 400 tons' capacity, at the Langlaate Estate mine; subsequently he was in charge of the square-vat cyanide plant at the Crown Reef mine, where he developed the decantation process that has since had such an important influence on the economics of gold-ore treatment in South Africa. W. A. Caldecott and J. Kelly filed application on March 5, 1898, for the use of an air lift in the treatment of slime pulp, first used on accumulated material on the property of the Rand Central Ore Co. Caldecott had used compressed air for agitation purposes as early as 1896. Other engineers and technicians who were prominent in the development of the process in South Africa included W. K. Betty, Fearnside Irvine, A. L. Simon, W. Bettel, A. F. Crosse, W. R. Feldtmann, and H. F. Julian, collaborator with Edgar Smart in the authorship of "Cyaniding Gold and Silver Ores," the first comprehensive scientific and technical textbook on the subject, published in 1903. To H. S. Denny belongs the credit for urging the introduction of tube mills on the Rand, in 1903, their suitability being demonstrated at the Robinson Deep. W. A. Caldecott was prominently identified with the introduction of the heavy gravity stamp in South Africa, the use of coarse screening in the batteries and the finer grinding of banket ores. F. L. Bosqui, sometime consulting metallurgist to the Rand Mines group, was largely responsible for the increased attention paid later to air agitation and the vacuum filtration of slime.

Technical progress in the early days of the cyanide process was due largely to the common sense and foresight of Hennen Jennings, who benefited all concerned by his open-mindedness. The association of Jennings with J. R. Williams, Charles Butters, and other contemporary engineers resulted in a quickening of scientific work in the Transvaal, which placed the *Journal* of the Chemical and Metallurgical Society of South Africa in the forefront of technical publications that purported to keep abreast with progress in cyanidation. The issuance, in 1912, of "Rand Metallurgical Practice," written by a group of specialists, indicated the co-operative and helpful spirit that existed among South African technicians, a spirit that was in evidence again more recently in the publication of a "Textbook of Rand Assay Practice."

Barberton, in the Lydenburg district of the Transvaal, shared honors with the Witwatersrand in regard to pioneer large-scale tailing-treatment plants. Soon after the demonstration at the Salisbury mine in 1890, W. A. Caldecott, who had been in charge of laboratory work, was sent to De Kapp, where he erected and operated a cyanide plant to treat the tailing from the mill of the Sheba Gold Mining Co. This averaged 50 dwt. per ton, from which a recovery of 70 per cent was made by simple leaching methods. The material had been insufficiently crushed for cyanide treatment; otherwise a better result would have been obtained. The cyanide used cost 2s. per pound, and was in the form of large, flat, black blocks, containing about 70 per cent KCN, the impurities being mostly carbon and iron carbide. It was packed in zinc-lined cases, the metal in which was cut into disks and turned into shavings for precipitation. Compara-

tively high strengths of cyanide solution were used at first, in line with practice at the Salisbury demonstration plant, with the result that the cyanide consumption amounted to about 10 lb. per ton of sand. The residues, containing about 15 dwt. per ton, were stacked. A year or so later the question of re-treatment arose, whereupon it was found that the gold content of the pile had shrunk to 9 dwt. per ton. The mystery remained unsolved until the ground on which it had rested was sampled and assayed, the result showing that so much dissolved gold had been washed down by rains that the top 3 in. of earth contained 38 dwt. per ton. A considerable amount of organic matter was associated with this, but it was eventually treated by burning, then mixed with the tailing before leaching. About 30 miles to the north, the Barrett Gold Mining Co. developed and put into practice what was probably the simplest mining and metallurgical scheme on record. The ore was so soft that it could be removed by pick and shovel. After trommel classification, the undersize was mixed with sand tailing and the product leached with cyanide solution.

Skepticism in the United States

In the United States the preliminary progress of the cyanide process was watched with undisguised scepticism. A distinguished mining engineer averred, late in 1890, that "to extract a reasonable percentage of the gold and silver, so great an excess of cyanide is required that the extraction is no longer economical or profitable. Moreover, if this excess is used, it is impossible completely to precipitate by the means advocated by the MacArthur-Forrest people. In fact," he concluded with sarcasm, "as a means of extracting gold I can more conscientiously recommend aqua regia than potassium cyanide." Nevertheless, in spite of pessimism in professional quarters, the process was ultimately established by sheer merit. About this time, H. A. W. Tabor and C. E. Wiswell, of Denver, Colo., advertised the process extensively, as agents for its introduction; many samples were received for testing, work that was done by Otto B. Amsden, who, with G. A. Duncan, the inventor of the perforated-pipe vacuum-filter frame and the use of water in discharging, were the first two students to matriculate at the Missouri School of Mines and Metallurgy. The outcome of this experimentation was not promising, and it was not until 1891 that Gill S. Peyton, part owner and manager of the Mercur mine, in Utah, after disappointing results with finely crushed ore, applied leaching with success, credit for which appears to have been partly due, at least, to Hal W. Brown. A 10-ton plant was erected at the Bill Hickman spring, famous in early Mormon history, two miles from the mine at Mercur. It consisted of a crusher, rolls, and five 7-ton leaching vats. In spite of the crudity of the method adopted for preparing the ore for cyanide treatment and the simplicity of the extraction process—bulk leaching for three days of material as coarse as 1-in. cubes—success crowned their efforts. The plant was enlarged later in the year to treat 50 tons per day, and again in 1893 to treat 100 tons per day. In 1896 it was remodeled to treat about 300 tons per day.

Developments in the United States

Mercur practice underwent considerable change when it became necessary to develop a new method for the treatment of the refractory ores that were discovered later. In 1896, D. C. Jackling was engaged by Captain J. R. De Lamar, who had organized a company known as the De Lamar Mercur Mines. The available ore was at a lower horizon than that from which material had been drawn for treatment in the manner described in the previous paragraph. Some oxidized ore was available, but the bulk of the reserve contained mispickel, realgar, and orpiment. Tests in Europe gave negative results; but Jackling elaborated a process and operated a pilot plant, the first of its kind, so far as is known, to treat so refractory a material by roasting and cyaniding. A novel system of leaching was introduced: The oxidized ore was crushed in breakers and rolls, and then separated by a 3-mesh trommel, each product going to separate bins. The cementing of the roasted ore was prevented by wetting, mixing with unroasted oxidized ore, and seasoning. The finer oxidized material was treated in a special mixer apparatus, and the coarser formed a bed up to 2 ft. deep, in the leaching vats, for the roasted ore, which had previously been crushed by breaker and rolls to about $\frac{1}{8}$ in. Percolation followed proved practice at the older Mercur mill, the solution being precipitated with zinc dust, an innovation that marked pioneer large-scale effort with this type of precipitant. A second innovation to be adopted in the United States was the use of lead acetate or other lead compound to increase the precipitating efficiency of the zinc dust. The efficiency of sodium instead of potassium cyanide was also demonstrated at an early date at this plant, whereby freighting economies were affected.

Early Recognition Denied Pioneers

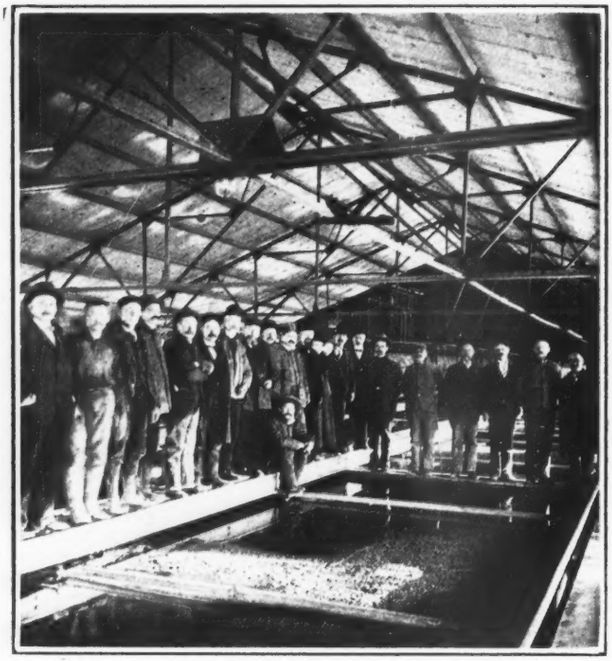
Tribute to the Scotch pioneers was ungenerous. In 1892 the first volume of *Mineral Industry* sponsored the statement that "Messrs. MacArthur and Forrest have no claims whatever upon those who wish to use the process,

The Salisbury demonstration plant in 1900

From right to left: Alfred James; J. S. MacArthur; G. Mason, an assistant from the Glasgow laboratory; F. Inglis, in charge of the erection of the vats, and later one of the shiftmen; W. A. Caldecott; W. Titmus, in charge of erection details and later a shiftman.

further than gratitude for having revived an old process and placed it in operation. In South Africa, favored by ores extremely well adapted to the process and by admirable business management, they have made an enviable technical and financial success, due credit for which must be given them." It is as well to interpolate, to the credit of the cyanide engineers who succeeded in proving the process on a commercial scale, that the demonstration tests in south Africa were first made on refractory ores or concentrates; operations at the Mercur plant in Utah

and elsewhere in the United States proved that many types of available ores were even more suited to the MacArthur-Forrest process than was the material first treated in the Transvaal. But history has shown that the inevitable reaction to initiative in others is (1) skepticism or derision, based on biased, hasty and immature judgment that disregards the thought and patience and personal funds needed and expended to develop the invention; (2) a belittling of satisfactory results obtained in the face of persistent opposition; (3) an attitude



First charge in leaching vats at Golden Gate mill

toward the inventor that ridicules reward or return and hints lack of originality; (4) that success, grudgingly acknowledged at last, applies only to restricted application and is due to abnormally favorable local conditions.

In this connection it is interesting to note that the work at Mercur and elsewhere was the precursor of many important applications of bulk leaching to metallurgy and chemistry. Thirty years afterward, a modification of this development in the initial introduction of the cyanide process was put in operation in Chile, for the treatment of nitrate caliche. The sponsor first met with ridicule, an official report maintaining that the essential feature of the process was impracticable. Others scoffed at the contention that the slime or "borra" problem could be solved by crushing much finer than was then considered advisable. Then, after a commercial and successful application of metallurgical leaching, on material containing the most refractory caliche in Chile, wide publicity was given to an inexperienced judgment that the process was merely a modification of existing practice and that it worked well on clean material.

Opposition to Process in United States

The influential opposition to the introduction of the cyanide process in the United States is well illustrated by the following extract from an editorial that appeared in the *Engineering and Mining Journal* of May 21, 1892.

"In regard to the merits of the process it may be said that while favorable testimony is scarce, the process has certain but limited applications. On some ores it has proved to be of value, but that it or any other process is a universal solution of the problems presented, every intelligent metallurgist knows is unfounded. It has been claimed that a MacArthur-Forrest plant was in existence at Deadwood, S. D. . . . The facts are that the process had been tried at the Golden Reward Works, which are now using, with great technical and commercial success, the barrel chlorination process, as introduced and developed at these works by Mr. John E. Rothwell, and that cyanide had proved a failure."

Thanks to the persistence and ingenuity of the pioneer cyanide workers, however, history has shown how biased and unscientific were these comments and prognostications.

Cyaniding Gradually Displaces Chlorination

Colorado was chosen as a radiating point for the introduction of the cyanide process in the United States; but the promotion methods of the American MacArthur-Forrest Co., as it was called, did not inspire confidence, and it would appear that any technical perception of the physics and mechanics of the process was sadly lacking in those who endeavored to introduce it. One of the earliest cyanide plants in Colorado was operated by the Creek Gold Extraction & Power Co. in 1893, as a custom mill. The ore was crushed dry to 20 mesh and leached in 20-ft. vats. In the same year the Poorman Silver Mines Co. reported a recovery of 85 per cent of silver from a 20-oz. tailing. The state, however, became the center of spirited competition between chlorination and cyaniding, the former being displaced gradually but surely by the newer process. This was mainly due to the fact that Philip Argall became metallurgist for the American MacArthur-Forrest Co. when Thomas W. Goad was made manager, the change in personnel being particularly advantageous to the development of cyaniding. The possibilities of the process in the treatment of refractory ores were brought to the attention of Argall by T. A. Rickard, who had made tests at the Hillside mine, Yavapai County, Ariz., in 1892, on sulphide ore. As a result, Argall became prominently identified with the metallurgy of gold in Colorado in the early days of cyanidation in the United States. The success of bulk leaching in Utah and South Dakota had led to some ill-advised attempts to apply the same method to unsuitable ores, containing large quantities of fine material, then termed dust. Argall, in confirmation of New Zealand practice, recognized at an early date the value of heat treatment of slime prior to cyanidation, and applied the idea to the treatment of Cripple Creek ores.

The Metallic Extraction company built the first large custom mill in Colorado to use cyanidation; it was designed and managed by Argall. Roasting, prior to amalgamation and cyanidation, was a subsequent development. This was in 1895. It proved successful on oxidized as well as on sulphide and sulphotelluride ores. The work done at Cripple Creek in this connection laid the foundation for subsequent practice with similar ores at Kalgoorlie, Western Australia, with particular reference to roasting practice. In 1887 H. R. Cassel introduced bromination at the Telluride mill, Colorado; but the method was changed to chlorination in 1904, which in turn was ultimately displaced by cyanidation in 1908. The Portland company adopted chlorination at Colorado Springs in 1902, to be superseded by cyanidation in 1912. It was not until 1910 that fine grinding and filtration treatment was introduced at the Victor mill.

(To be continued)

Diamond Mining in Central Africa

By ALFRED B. SABIN

Mining Engineer, Butte, Mont.

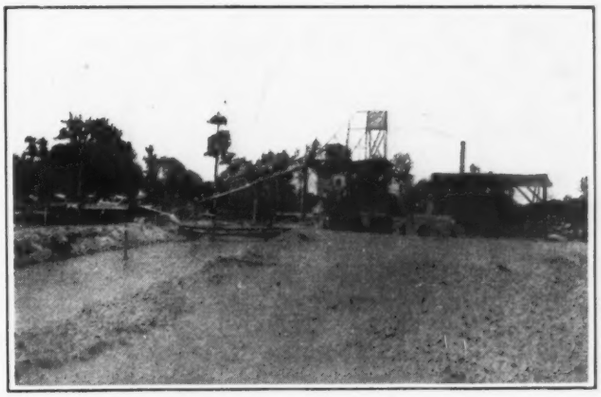
ALFRED B. SABIN

LITTLE if anything seems to have been written for publication in the last few years relating to the mining methods employed by the companies in the Belgian Congo and Portuguese Angola for the winning of diamonds. And yet they should be of interest, if not of value, to mining men with similar problems in other parts of the world. The territory referred to is in those parts of the Belgian Congo and Portuguese Angola drained by the upper Kassai. It is a region of many rivers and streams which run the year through. The topography is middle-aged, with rounded hills typical of a moist climate. Uplands are covered by what is known as "bush"; this consists of small trees and bushes and thick-growing elephant grass, which sometimes attains a height of as much as eight feet. Most valleys are filled to choking with lofty, vine-hung trees, ferns, palms, and many varieties of underbrush and flowering plants It is in these valleys that the diamond-bearing gravels are found.

One of the most difficult things to appreciate is the problem of material transportation. Practically all manufactured articles must come from Europe by ocean boat to Matadi, by narrow-gage railroad around the rapids to Kinshasa, by river boat up the Congo and Kassai rivers to Djoka Punda, around more rapids by narrow-gage railroad, another boat, and finally by ox wagon or motor truck for another fifty to two hundred miles. The expense of this transportation, combined with a supply of cheap labor, has up to the present made complete mechanical operation in mining impracticable.

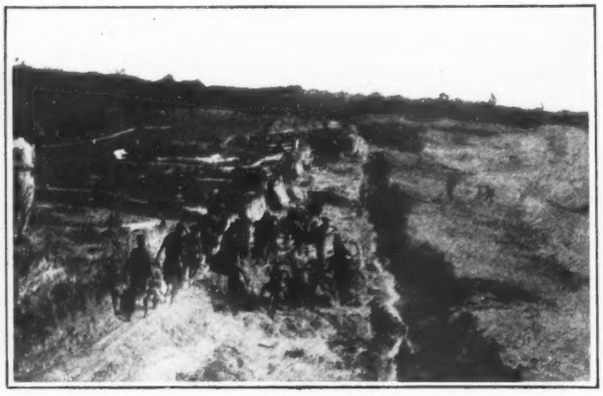
Doubtless many engineers reading this may think they have labor in its crudest state, be it Malay, Arab, coolie or Indian, but I should like to ask any of these employers of primitive workmen what they would think of a gang of new men who fill their shovels with their hands, and who require several months' experience in running a wheelbarrow to master its complexities. Such are the natives recruited for work in Angola. But their lack of dexterity is not to be wondered at when one realizes that until a few years ago the white man and his machinery were entirely unknown to them, and that even today many natives who come for work have never before seen an implement more complicated than a native knife or a hoe of wood or bone. However, exasperating as they sometimes are to the white man who wants to see the work progress, they do learn a good deal in the course of a year. Moreover, they are of a natural cheerful disposition, if they have half a chance. With white laborers, if one hears considerable shouting and talking among them it is generally supposed that no great amount of actual work is being done. With the black boys the amount of work is practically proportional to the noise. It is a pleasing sight to watch a crew of thirty good shovel men moving overburden to the rhythm of a native chant. Some boy will sing the verses, which are often obviously impromptu and refer to the work, their boss, or what not, and all join in the chorus. A person with discernment can often notice a relationship between their songs and the negro spirituals of our South. They contain the melancholy and much of the pathos. Too, if one wishes to see dancing done with considerable finish, a great deal of realistic acting, and done for the pure love of it, he should be in a clearing on the top of some hill in Central Africa as the moon comes up. There, to the boom and tum, tum, tum of the drums, will be seen a circle of dusky shapes writhing, twisting, clapping, and chanting with all they have. They go mad, they get drunk with it, and keep it up until daybreak. And sorry laborers they are the next day.

With the constant improvement in transportation facilities and the education of labor in machine operation, machinery is creeping in. It was only a few years ago that a man would be sent out with a small amount of equipment carried by porters to some valley to get diamonds—and diamonds he would get. From lumber sawn on the spot, a few nails, and some screen were made Joplin jigs and rocking screens. Gravel shoveled into native baskets was transported on the heads of natives from gravel pit to screens. The screens and jigs were housed in what is known as a "chitanda," a thatch roof supported on poles and open on all sides. Sometimes these operations attained considerable size. In one chitanda might be found as many as eighty rocking-screen Joplin jig units with a native crew at each. To obtain satisfactory results with this equipment the jig pulsations must be of a certain strength and frequency. For one



One of the mills on Luaco Creek

man to attend to this and watch the other work as well seemed an impossibility until someone had the happy thought of running the whole operation to beats of a drum. The drummer was taught to count, and by requiring the jig men to keep time with the drum the correct number of strokes was assured. The jigs would then be skimmed, another lot of gravel put in, and the drummer would again beat out the correct number of pulsations. Such an operation might employ more than eight hundred natives. The concentrates from the jigs were re-jigged and then picked over by hand.



Foreground, loading wheelbarrows in a gravel pit. Background, throwing overburden from gravel bench

The next development was to use wheelbarrows for transporting the gravel. Some difficulty was experienced at first, since the transport crew wished to carry them on their heads as they did the baskets. The rocking screens were replaced by hand-driven trommels next, and the jigs by hand-turned pans. Nearly all this hand-turned machinery has now been replaced by power-operated equipment. Wherever the size of the deposit warrants, the wheelbarrow is giving away to tracks and cars. Mechanical shovels and conveying equipment seem to be the next logical development.

The diamonds are found in the stream gravels to a greater or less extent practically all over the region of the upper Kassai. In valleys where small tests give favorable results a more detailed prospection is made by sinking pits to bedrock over the area in question. The gravel from the pits is treated with the rocking-screen Joplin jig apparatus. The pits are usually arranged in straight lines running across the valley at regular intervals. All results are plotted on a map made by the engineer in charge of the prospection.

Issuing noon-day rations

It will be remembered that the valleys are usually deep in vegetation. For the purpose of prospection, however, only the bush on the pit lines is cut. The interlocking branches of the trees above make the clearing appear a tunnel in the denser growth. In such places water must usually be contended with, and the use of spiling is often necessary. Although conditions vary greatly, an average pit log of a medium-sized valley would show about six feet of overburden and three feet of gravel. The bedrock is usually highly metamorphic and often so decayed that it may be easily dug with a round-pointed shovel. To make certain that no diamonds are lost, it is the custom to take with the gravel a little of the bedrock unless it is too hard, in which case it is cleaned with wire brushes.

If, after prospection, it seems advisable to open an exploitation in the valley, the mill site is chosen, usually at the down-stream end of the profitable area. In the larger river valleys, where the cost of changing the stream bed of the river would be prohibitive, a levee of rocks and earth is built along the natural bank to prevent flooding of the valley floor and gravel pits during high water. In smaller valleys the stream is confined to one side by temporary dikes. A strip out of the center is cleared, the gravel is uncovered and stacked, and the overburden is built into permanent dikes for the stream. The mill site is prepared on one dike by stacking the gravel, filling in with earth, and laying the foundation timbers. Drainage is effected by running a ditch of small gradient a sufficient distance down the valley to drain the bedrock, or pumps may be used for this purpose, if power is available.

Preparing dikes. Native water-boy in foreground

When the dikes are completed the stream is turned into the permanent channel which they form. The forest is cleared off and a primary overburden cut about twenty feet wide down to the gravel is opened across the valley. This is so far mostly hand-shovel work. The gravel from the cross-trench is thrown into cars or wheelbarrows and transported to the mill. When bedrock has been cleaned, the overburden shovel crew follows, filling in the pit, except for a drainage ditch next to the upstream gravel face, and uncovering a new gravel bench. So, back and fourth across the valley the face advances. When it has reached the limiting distance for economical transportation, a new area is diked off above and the mill moved up to its new site.

American engineers have been prominent in the development of this diamond field since its beginning.

The Great Earthquake of 1923 in Japan

By W. H. EMMONS
Director Minnesota Geological Survey

A VOLUME entitled "The Great Earthquake of 1923 in Japan" was recently issued by the Bureau of Social Affairs of the Japanese Home Office. The work of 615 pages is supplemented by an additional volume containing maps and charts. In the words of the Home Office, it is the English version of a compilation in Japanese of a history of the great earthquake, which was issued "in order to inform the world at large of what our people suffered from a terrible outburst of the potential forces which at any time may overwhelm a nation, and also as a slight token of gratitude to the millions all over the world for the generous sympathy shown to this nation on that tragic occasion."

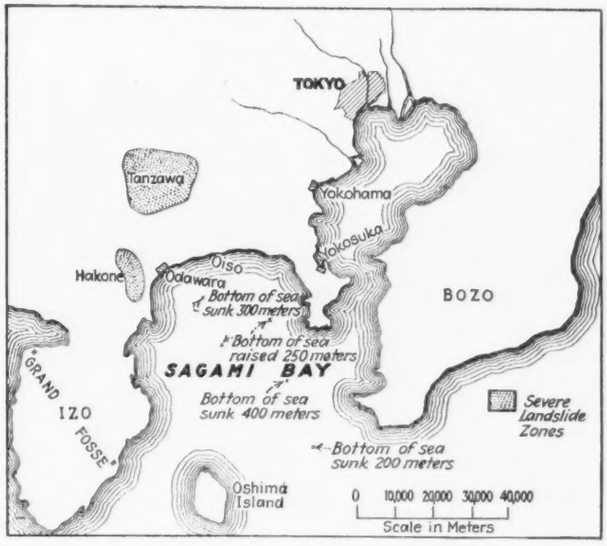
The report includes statistics, maps, and other geologic and geographic data. One reads here the epic of a great and courageous people harassed simultaneously by earthquake, fire, sea waves, and cyclone! The seven prefectures affected had a population of 11,758,000. Of these 104,619 were killed and missing, 52,074 were injured, and a total of 3,404,898 suffered either the total loss of, or damage to, their homes. The total loss was estimated to have been $2,500,000,000.

In 1921, as a member of the American mining commission of the South Manchurian Railway, it was my good fortune to visit the laboratory, in the Tokyo Imperial University, of Prof. F. Omori, one of the world's leading authorities on seismology. I was much impressed with the great amount of work which he and his associates have done in the organization of geological and seismographic data of Japan. No one was so well equipped to interpret the great disaster of 1923. His sad death soon after the earthquake must be regarded by all as a great loss to science. It was due to his genius and enthusiasm that the seismographic laboratory was so well equipped to study the disaster and its results.

The report issued by the Home Office is primarily on sociological matters, but it contains a brief account of the geologic setting of the area affected by the earthquake and detailed maps showing changes in elevation of the shore and the bottom of Sagami Bay. The geology of Japan has been mapped with great detail. It is an area of Pre-Cambrian and Paleozoic, Mesozoic, and Tertiary rocks that are thrown into complicated folds and extensively faulted. A great zone of deformation strikes northeast through the main island, and this is crossed near the center of the island by the "Grand Fosse," also a zone of deformation on which lies the great volcano Fujiyama.

The earthquake appears to have originated in Sagami Bay. I have reproduced the map of this bay and have indicated the position of the Grand Fosse. This zone of deformation, which strikes northwest across the island, is continued southeast into the Pacific, extending to Hichijo Island.

As a result of the earthquake, the coast of the mainland showed differences of elevation amounting to seven or eight meters at places, but it soon settled to almost its original positions; subsidence amounted to a half meter



Area of the earthquake in Japan in 1923

or less, and the maximum elevation on land, as shown on the map, was 2.3 meters.

In view of the small amount of elevation or subsidence of the shores of the bay, the changes in the level at the bottom of the bay are noteworthy. The bottom of the bay, which at places is about a mile deep, had been mapped by soundings before the earthquake, and after the earthquake; further, it was mapped independently by the Government Fisheries Institute and by the Hydrographic Department of the navy. As shown in the accompanying map, the movements of the sea bottom at places amount to hundreds of meters. Ten kilometers south of Oiso the sea bottom sank 300 meters, and only 13 kilometers southeast of this point it rose 250 meters. About 25 kilometers southeast of this elevated area, it sank 400 meters. Thus the total vertical deformation amounted to 650 meters. A level plane by this deformation would have been thrown into mountains with crests over 2,100 ft. above the lowest depressions. It is noteworthy that all of the intense deformation was confined to an area only 50 miles long and 40 miles wide. The borders of this area are clearly defined. The amount of deformation on the shore line, as already stated, was

small. Oshima Island showed little deformation, and numerous soundings around the south edge of the deformed area indicated no change.

The area of deformation and the area of destruction were practically confined to the Grand Fosse and the country northeast of it, the stricken area extending northeast of the Grand Fosse about 190 kilometers. Maximum sinking along the Grand Fosse was 120 meters. Northeast of that, extending northwest from Oshima Island to near the mainland, a distance of 22 kilometers, there was a zone of elevation. The sea bottom rose 100 meters over most of this zone. Adjoining this ridge to the northeast was a great zone of depression 60 kilometers long and 30 kilometers wide. In this zone the sea bottom sank from 20 to 210 meters. To the northeast of this zone there was an area of elevation extending from the south end of Bozo Peninsula northwest to Manazuruga Point, about 60 kilometers across the bay. In this zone the sea bottom rose at places 250 meters, but at one point 20 kilometers west of Bozo Peninsula it sank 400 meters, and at a point near Oiso it sank 300 meters. This zone is in line with the mountainous area of Hakone and that of the Tanzawa group, where the earthquake was very severe and landslides were numerous. It includes also the Miura Peninsula, where shocks were especially severe and which, according to the Central Meteorological Observatory in Tokyo, was the epicenter of the violent shock of September first. The zone from Bozo Peninsula extending northwest to Tanzawa Mountains was regarded as the center of disturbance, and it is on the northeast margin of this zone that Yokohama and Tokyo are situated. Yokohama, being nearer the center of deformation, suffered more from shock. These cities are somewhat removed from the epicentrum, and their disaster, according to a report of the Observatory in Tokyo, may be attributed largely to the style of construction of houses and to the conflagration that accompanied the seismic convulsions.

The disaster constitutes one of the most extensive diastrophic movements recorded in historic times. There does not appear to have been much faulting on shore around Sagami Bay. The deformation at the bottom of the bay was doubtless due in part to faulting, but the soundings did not indicate extensive or persistent faults, and the maps seem to interpret some of the movements as folds. The relatively small and very deep holes are not easy to explain. It suggests very localized and very intensive block faulting. The data altogether seem to show that vast earth movements may take place more rapidly than is generally supposed.

After-shocks continued for several days. According to Dr. A. Imamura there were 936 separate shocks between 11.58 a.m., Sept. 1, and 6.00 a.m., Sept. 5. The report includes a detailed account of the assistance given the Japanese in the time of their great misfortune by forty foreign governments. The acknowledgments to America and Americans, and especially to the efforts of American Ambassador Woods, are particularly grateful and sincere.

Tube Milling on the Rand

IN A paper recently presented before the Empire Mining and Metallurgical Congress, the authors, Carl Davis, J. L. Willey, and S. E. T. Ewing, give the following details of the cost of tube milling at the West Springs Mill, Transvaal:

	Cost per Ton Milled, Pence
White wages	1.0464
Native wages	.9250
Liners suspense account	1.0714
Tube mill spares, castings and other parts	1.7928
Conveyor belts	.2179
Sundry stores	.1357
Oil and grease	.3536
Lime	.2286
Electrical material	.0571
Sundries	.3750
Workshops	1.3696
Electric power	10.1821
Air power	.2983
Assaying	.1429
Return solution service	.1321
Dorr classification and tube mill circuit pulp elevation	.8750
Reject pebble transport, sorting and crushing	1.4500
Total	20.6535
	= 1.721 shillings

The grading of the final product is

+60	+90	+200	−200
Nil	3.30%	23.37%	73.33%

The figures show that 96.7 per cent of 134,400 tons of —90-mesh was produced, or 20.83 kw.-hr. per ton of —90-mesh produced.

The most interesting feature of the West Springs plant is that it was designed with the express intention of grinding the whole of the ore to a considerably greater degree of fineness than that common to ordinary Rand practice, particularly on the Central Rand, where owing to the nature of the ore and type of existing plants, such a degree of fine grinding is not economically desirable. It is well known that fine grinding is likely to be a costly process, and that as the degree of fineness of the finished product increases, so, normally, do the amount of power and plant required to perform the operations tend to increase on a rapidly rising scale. It is, of course, perfectly possible to grind to almost any desired degree of fineness by means of stamp milling only, and, with a greater degree of economy, by means of stamp milling with tube milling combined.

Earth Rises and Falls in Periodic Ocean-Like Tides

THE "solid" earth rises and falls, just as does the water in the oceans, avers Dr. Walter D. Lambert, scientist of the U. S. Coast and Geodetic Survey, in a report prepared for the section of geodesy of the International Geodetic and Geophysical Union, in assembly at Prague, Czechoslovakia. The tidal movements of the earth's crust are attributed by Dr. Lambert to the same forces which actuate ocean tides.

During the last few years, Dr. Lambert states in his report, experiments by Prof. A. A. Michelson at Pasadena, Calif., and by other scientists, have proved the existence of earth tides and have shown something of their periodicity. Exact measurements of the rise and fall of these tides have not as yet been accomplished.

That the instrumental effect of the ocean tides is considerable, is evident, Dr. Lambert points out, from the fact that three-quarters of the globe is covered by water. "It is rather difficult to exaggerate the distance to which the secondary effects of the oceanic tides may be felt," says Dr. Lambert. "It is perhaps not too much to say that there is probably no place on earth so remote from the ocean that its earth tides are unaffected by ocean tides by an amount equal to several times the probable error of a good determination with the Michelson-Gale apparatus. It has been shown that the tides in the Atlantic ocean have an appreciable effect at Williams Bay, Wisconsin, some 800 miles distant."

Flotation Practice at the Sullivan Mill

TO FACILITATE the inspection of its new 4,000-ton flotation plant at Kimberley, B. C., by the members of the Empire Mining and Metallurgical Congress on the occasion of their recent visit, the Consolidated Mining and Smelting Co. of Canada prepared a detailed description of the plant and process, which was issued to the visitors in the form of a small pamphlet. By permission of the company the following is abstracted and reprinted from the pamphlet:

Ore is delivered to the concentrator receiving bins from the Sullivan mine by the Canadian Pacific Railway after a 3½-mile haul. The maximum size of feed at this stage is 2½ in. The grade averages 11 per cent Pb, 75 per cent Zn, and 40 per cent Fe.

From the bin the ore is delivered to the grinding rolls plant. This has two sets of 72-in. diameter by 20-in. face Garfield-type rolls in series. At a crushing rate of 3,500 tons per seventeen hours, the power required for No. 1 set is 80 hp., and No. 2 set 135 hp., giving the following crush:

	Cumulative Per Cent				
	+ 2 in.	+ 1 in.	+ ½ in.	+ ¼ in.	— ¼ in.
No. 1 rolls feed.....	5.9	44.1	63.9	79.6	20.4
No. 2 rolls feed.....	—	7.5	36.2	66.6	33.4
No. 2 rolls product.....	—	—	3.3	37.4	62.6

The discharge from the roll plant is carried by a belt conveyor from beneath No. 2 rolls to a belt and tripper feeding the fine-ore bins. As the conveyor discharges, a cut of 100 to 1 is taken as a sample of mill feed and is conveyed to the sample mill.

The fine-ore bin is of 3,000 tons' capacity. The feed is delivered from the bin to four conveyors by means of twenty-eight roll feeders of the same type as used under the 1,800-ton bin. The ore from the feeders falls on four 18-in. by 6-ply conveyor belts which deliver it to the four 18-in. by 6-ply weighing conveyor belts feeding the four primary mills. Each of the four weighing conveyors is equipped with a Merrick conveying weigher. Electrically operated, and synchronized with the weightometers, are the four Rate-O-Graphs, which record the tons of feed per hour to each mill at any instant during the twenty-four hours.

Fine Grinding and Classifying

The work accomplished by the fine grinding and classifying units consists in the reduction of the 3,500 tons of ore per day from a sizing indicated by the screen analysis of the roll plant product at 3.3 per cent plus ½ in., 37.4 per cent plus ¼ in., with 8.1 per cent minus 200 mesh, to that of the pulp ready for flotation at 1.5 per cent plus 100 mesh, 13.9 per cent plus 200 mesh, and 86.1 per cent minus 200 mesh.

All of the fine grinding units group themselves into three: primary, secondary, and tertiary. The primary section consists of four Hardinge conical mills, 10-ft. by 48-in., each mill discharging into one-half of a Dorr quadruplex classifier, 20 ft. long and using 4-ft. rakes. Separation made in these classifiers results in a finished product amounting to 1,200 tons per day, which overflows the classifiers and is pumped to the surge tank ahead of the lead rougher flotation machines. The sand, raked to the back of the classifiers, is laundered to the four secondary mills. The primary classifier overflow shows a screen analysis of 1.4 per cent plus 100 mesh, 12.6 per cent plus 200, and 87.4 per cent minus 200 mesh, and the sands will average 11.5 per cent plus 35 mesh, 73.8 per cent plus 200, and 26.2 per cent minus 200 mesh. The mills discharge at 70 per cent solids, and water is added to overflow the primary classifiers at 40 per cent solids.

A ten-way distributor serves the secondary classifiers. The sand of the primary classifiers is the original feed to the secondary mills. This is augmented by the sands settled out in the secondary classifiers from the lead rougher middling and the lead cleaner tailing, which joins the discharge of the secondary mills as feed to the secondary classifiers.

The average tonnage of sands settled out in the secondary classifiers is 20,000 per day, which, based on primary classifier sands, represents a circulating load of 870 per cent. Work done by the secondary mills is indicated by screen analysis of the secondary classifier overflow at 3.8 per cent plus 100 mesh, 25.8 per cent plus 200 mesh, and 74.2 per cent minus 200 mesh.

The company's experience has been that the resulting work done in the secondary mills increased with an increased circulating load. Limits of dilution in the secondary classifier feed are the mechanical limitations of the sand-raking capacity and the bulk of flotation pulp to the lead roughers. A Genter thickener in the lead rougher bay is used to experiment on the benefit to be derived from making the grinding and flotation circuits independent of each other through reducing the dilution of the flotation pulp and increasing the classifier dilution.

Ten standard Dorr "D" duplex classifiers, 6 ft. by 25 ft., comprise the secondary classifier unit. The rake speed is twenty-three strokes per minute, and the slope of the classifiers 2½ in. per foot. Feed density to the classifiers is 70 per cent solids, and the overflow density 42 per cent.

There are four 8 ft. by 48-in. Hardinge mills in the secondary grinding unit. Circular trommel screens fitted on the discharge of the mills protect the pumps from balls and chips and eliminate considerable wood pulp from the subsequent flotation. Six 6-in. Wilfley sand pumps handle the secondary mill discharge to the ten-way distributor on the primary floor.

Overflow from the secondary classifiers is laundered to two 6-in. Wilfley pumps discharging to the tertiary classifiers. These consist of two 10-ft. Dorr bowl classifiers and two 6 by 25-ft. standard classifiers operating in parallel. The sand from these four classifiers is the feed to the two tertiary mills situated immediately below.

The tertiary circuit is a trap for any coarse particles

of sand escaping from the secondary circuit. Its work is illustrated by the feed screen analysis of 3.8 per cent plus 100 mesh, 25.8 per cent plus 200 mesh, and 74.2 per cent minus 200 mesh, and the overflow of the tertiary classifiers at 1.5 per cent plus 100 mesh, 13.9 per cent plus 200 mesh, and 86.1 per cent minus 200 mesh. Overflow of the tertiary classifiers passes to a 30-ft. surge tank, from which it is fed to the lead rougher flotation machines through a six-way distributor at 40 per cent solids.

Flotation Reagents

West of the secondary ball mill bay are situated the reagent feeders and storage for soda, copper sulphate, cyanide, bichromate, and grinding balls. Soda is fed on a conveyor belt driven by a ratchet drive at the rate of 416 lb. per hour, and discharges into a hopper in which it is dissolved, and flows by gravity to the primary pumps. Copper sulphate is dissolved in two lead-lined wood tanks, and fed to the zinc rougher circuit by means of cup feeders. Sodium bichromate is fed in a similar manner to the copper sulphate. Sodium cyanide is dissolved in a tank in the southeast corner of the tertiary classifier floor, from which it runs to the primary pumps.

The Flotation Section

Owing to the natural susceptibility of galena to oil flotation, this mineral is floated first. The remaining pulp, containing the zinc and iron mineral, is then treated with a reagent that causes the zinc mineral to become amenable to oil flotation. The zinc is then floated from the iron, resulting in the separation of the three.

The minerals constituting Sullivan ore are galena, marmatite, pyrrhotite, and pyrite. Their metal content is approximately 11.0 per cent Pb, 7.5 per cent Zn, and 40 per cent Fe. The silver, which is associated with the lead, assays 4.2 oz. per ton of ore. The specific gravity is 4.3.

In the grinding section of the mill circuit 3 lb. of sodium carbonate, 0.1 lb. of sodium cyanide, and 0.4 lb. of a mixture of mineral oils are added per ton of ore. This mixture consists of 60 per cent water-gas tar, 20 per cent coal-tar creosote, and 20 per cent cresylic acid.

From the first bank of six 18-cell machines the galena is floated. In this operation recovery is stressed rather than grade. To insure a maximum of recovery, more oil is added to the agitating cells along the machines. As a final insurance, an excess of oil is used on the last four cells, and the concentrate of these last cells is returned as a middling product to the grinding section.

There are now three products: a rough concentrate which contains 33 per cent lead, 12 per cent zinc, and 20 per cent iron; a middling which contains 10 per cent lead, 13 per cent zinc, and 40 per cent iron; and the pulp remaining in the machine, which contains a small quantity of galena, 9 per cent zinc, and 45 per cent iron. The first concentrate is dropped to the end of the mill for cleaning, the middling is returned to the head of the mill, and the de-leaded pulp is passed into two distributors which feed the zinc roughing machines.

At the Zinc Roughers

The density of the pulp feeding the zinc rougher machines has now dropped to 30 per cent solids. The first step is to render the zinc sulphide floatable by the addition of 0.6 lb. of copper sulphate per ton of original feed. This is added to the two distributors with 0.1 lb. of sodium bichromate, which serves to render the iron less floatable.

As with the rougher lead circuit, recovery is stressed on these machines. A middling product is similarly made by the use of an excess amount of oil. A rougher concentrate is made from the first twelve cells of each machine, and is laundered to the zinc cleaning section, the middling is made with six cells, and goes to two mills for a regrind, and the tailing flows to the storage area south of the mill. As an extra precaution, to insure clean tailing, the last three cells are of the sub "A" type. A low-pressure air jet at the bottom of the cell froths any remaining oil.

The rougher zinc concentrate contains 3.5 per cent lead, 36 per cent zinc, and 25 per cent iron; the middling, 2 per cent lead, 10 per cent zinc, and 45 per cent iron; the tailing, by the reason that it contains 50 per cent iron, can be designated as an iron concentrate.

Cleaning and Re-treatment

The next step in the operation is the cleaning and recleaning of the rough zinc concentrate. Cleaning is done in one 18-cell machine. The feed consists of the rougher zinc concentrate, re-treatment zinc concentrate and the tailing from the zinc recleaning machine. Here the grade of the concentrate is stressed, the operation consisting of floating the higher-grade zinc and leaving the iron and combined particles of lead, zinc, and iron in the machine. The concentrate made on this machine assays 42 per cent. This is laundered to an eight-cell recleaner machine, while the tailing, which is composed of 3.7 per cent lead, 16 per cent zinc, and 38 per cent iron, joins the zinc middling product at the regrind ball-mill unit in the re-treatment section.

The recleaning is done in one 8-cell machine. Here a final zinc concentrate is made and sent to the dewatering section. This concentrate consists of 2.8 per cent lead, 50 per cent zinc, and 11.5 per cent iron as sulphides. The tailing from this machine joins the feed to the cleaner machines.

No reagents other than water are added to the cleaning section. The effect of the copper sulphate, bichromate, and oil used in the first zinc float is sufficient to complete the cleaning operation.

A special unit is used to treat the zinc middling and cleaner tailing. It would not be safe to return these products to the head of the mill, for the reason that the zinc, once treated with copper sulphate, would tend to float with the lead. This unit is composed of two ball mills with classifiers in which the pulp is reground, two Genter thickeners in which the pulp is thickened to the density best suitable to its subsequent treatment in the flotation machines, a surge tank in which the pulp is reconditioned, and one 8-cell and one 18-cell machine. Immediately after grinding and thickening, the pulp is discharged to the surge tank, where 0.8 lb. of cyanide per dry ton of re-treatment feed is added. The cyanide serves to annul the action of the copper sulphate added in the first treatment in the zinc rougher machines. The pulp is then pumped to one 8-cell machine, where a low-grade lead concentrate is made. This concentrate is discharged to a pump and delivered to the head of the mill, where it joins the fresh feed at the secondary grinding units.

Copper sulphate is added to the tailing, and a zinc concentrate similar to that in the rougher zinc circuit is made.

Cleaning of the rougher lead concentrate is carried out much the same as the cleaning of the rougher zinc. The concentrate to be cleaned is distributed to three 8-cell

machines. The concentrate from these machines contains 55.0 per cent lead, 8.0 per cent zinc, and 15 per cent iron. This is pumped to two 8-cell machines running in parallel, and the tailing, containing 18.0 per cent lead, 13 per cent zinc, and 35 per cent iron, is returned to the secondary grinding circuit at the head of the mill.

A final lead concentrate is made on the recleaning machines, which is composed of 25 oz. silver per ton of concentrate, 70 per cent lead, 4.6 per cent zinc, and 5.9 per cent iron. The tailing is returned to the cleaner feed, and contains 44 per cent lead, 9 per cent zinc, and 20 per cent iron. No reagents are added to the lead cleaning section.

The flotation operation divides the ground sulphides into three products, consisting of a 70 per cent lead concentrate, 50 per cent zinc concentrate, and 50 per cent iron residue.

Control of the separation is accomplished principally by close observation of color and nature of the froth. Cuts of the pulp at important points in the mill are run over gravity tables for constant observation.

After thickening and filtering the concentrates go to railroad cars for shipment.

Government Strikes Potash in New Mexico

THE second government core test in New Mexico, made jointly by the Department of the Interior and the Department of Commerce under the federal potash act, has disclosed numerous beds that contain potash, but none of them are both thick enough and rich enough to have prospective commercial value. This announcement was made by the Geological Survey, which has just completed its examination of the core.

The test was made in Sec. 14, T. 20 S., R. 29 E., Eddy County, N. M. The site was selected by the U. S. Geological Survey, and the drilling contract was made by the Bureau of Mines. As the contract was made prior to the amendment of the potash act, the work was done under the restrictive clauses of the original act, which required reimbursement of the government by all land owners or lessees within a radius of one mile from a proposed drilling site, and seriously hampered the selection of desirable sites. Under the circumstances the results obtained are fairly to be considered distinctly encouraging.

The test hole was drilled to a depth of about 1,100 ft., and the top of the salts was reached at about 335 ft. Indications of potash began at about 350 ft. Owing to difficulties with the drilling solutions, recovery of the core in the first 50 ft. of the salts was poor. This was remedied, however, by recoring this portion on an offset after the completion of the well, so that the final recovery was excellent.

A preliminary study of the core as received from the Bureau of Mines was made by the Geological Survey in the field, but selected portions, comprising about 130 ft., were shipped into Washington for study in the Geological Survey laboratories. All this material was subjected to mineralogic examination and qualitative tests for both potash and boron. Only four of the samples tested for boron gave indications of containing as much as 0.1 per cent of B_2O_3, and none of these was quantitatively analyzed. Thirty-eight samples were analyzed quantitatively for potash.

Discussion

Manganese in Arkansas

THE EDITOR:

Sir—I must say that I would hate to see a reduction made in the manganese tariff. I would rather see an increase. I recall that the tariff committee met in St. Louis, Mo., in the spring of 1917 to confer with us operators on barytes ore. Certain interests then spread the same propaganda that the United States did not have enough barytes to take care of domestic needs. I told the committee that I saw enough barytes in California and Nevada to supply the domestic needs for the next 500 years. This was then unknown to the industrial East. We succeeded in getting a small tariff, but not enough.

The same stands good for manganese. I know of deposits out West, development of which was never thought of on account of the freight haul and the price that was offered. I am at present operating in southwestern Arkansas on the manganese deposits of the Caddo Gap and De Queen quadrangles, and I am much pleased with my last two years of development work as to quality and quantity of ore.

The manganese deposits in west-central Arkansas cover a large area extending from Pulaski County, at the center of the state, to the western border of Polk and Howard counties on into Oklahoma. It seems that the novaculite is the mother lode of the ore. The novaculite ridges range from 5 to 15 miles wide throughout this area. They have been described in Bulletin 660 of the U. S. Geological Survey by Hugh D. Miser, who visited the district in 1916 and examined the prospects then being worked. This area has been worked only in a small way at two periods, one in 1888 and 1889 during a gold excitement, and in 1915 and 1916 during the war, when the Mississippi Iron Co., of St. Louis, needed 200 tons to bring its pig iron up to the manganese requirement. When that company ceased operations nothing more was done until I started work in September, 1925.

The ores consist of oxides, four of which are psilomelane, pyrolusite, manganite, and wad. The manganese ores occur from 6 in. to 4, 6 and 8 ft. wide, and on plunging anticlines 20 ft. wide, in a cement breccia containing 50 per cent silica which would have to be milled, and 7 to 20 ft. wide in manganiferous clay. In the lower division of the novaculite 6 miles west of Caddo Gap, a manganese vein 4 in. to 12 in. wide and even up to 6 ft. is found throughout a 40-acre tract.

A composite sample from thirty-nine localities in Pike, Polk and Montgomery counties was made up by Mr. Miser in 1916. Specimens consisted of wad, psilomelane, manganite, and bog manganese. Twenty grams of mineral from each localitiy were mixed to make the sample. The analysis showed manganese, 43.52 per cent; iron, 6.72; silica, 5.17; phosphorus, 0.35; manganese dioxide, 64.60; alumina, 4.80; lime, 1.42; magnesia, trace; sulphur, 0.62; moisture, none. We also have deposits of ore of chemical grade 4 to 20 ft. wide which shows manganese 56.66 to 59.55 per cent; iron, none to 0.14; phosphorus, none; silica, 0.22 to 0.52; and manganese dioxide, 82.10 to 90.52.

I had an order recently for a car from the Electro-

Metallurgical Co., New York, to be shipped to Niagara Falls, N. Y., at $50 per ton, in which shipment the analysis showed only 45 per cent Mn and 66 per cent carbon dioxide, no phosphorus and 0.14 iron. I have also received an inquiry from an engineer for the Eastern Electrolytic Zinc, Inc., which will be in the market by the first of next year for 100 tons a day, and ore containing 25 to 30 per cent, or even lower, would do. I am satisfied that I could fill the order for years to come in a radius of 6 miles of Caddo Gap and Norman, Ark., as I know of steam-shovel deposits of bog manganese that runs from 12 to 28 per cent. The development work done by Rose & Rowe, of Caddo Gap; J. M. Dunkley, of Hawes, Ark.; and J. E. Myers, of the Arkansas Manganese Trust at Mena, Ark., shows that the deposits extend in depth 200 to 300 ft. below the water level in lower formation of the novaculite.

Caddo Gap, Ark. J. P. Rose.

* * * *

A Philipsburg Operator's View

The Editor:

Sir—Any action directed to lower the price of manganese below the present quotations will be so severe to us in the West that I feel justified in saying that our operations would be suspended accordingly. Therefore lowering or removing the tariff now on imported manganese, we feel, would effect us to this extent.

Stoddard & Co. has manganese deposits (in operation and ready to operate) which show approximately 50,000 tons opened up and ready to mine; also an inland market for our full production of all ores assaying 35 per cent manganese and over. All of this is shipped direct to steel manufacturers.

The Philipsburg manganese district shows about 500,000 tons of 35 per cent manganese, and better in reserve, and could be accepted as such by any reputable mining engineer, notwithstanding the information that there is not a domestic supply known.

Philipsburg, Mont. A. D. Stoddard.

* * * *

Manganese in Nevada

The Editor:

Sir—I am the owner of a manganese property near Ely, Nev., which I have been operating since 1917. During operations from 1917 to 1924, the product mined was shipped to various of the Carnegie Steel Co.'s plants in the East and Southeast. Approximately 3,500 long tons was shipped during this period. Since 1924 about 4,000 tons of high-grade ore has been shipped to the Columbia Steel Co., at Ironton, Utah. I have at present about 2,000 tons of shipping ore in sight.

Owing to location, local conditions, and freight rates, the present prices of manganese ores show a very small operating profit, under the most careful and economical management.

The property is developed to a depth of 220 ft., showing the ore going down on the contact, and with a considerable length of the contact to be developed. A lower tariff on this mineral will mean that my property cannot possibly be continued as a profitable producing mine, and it will, of necessity, have to be abandoned.

Any reduction of the present tariff on manganese ores will destroy the manganese-mining industry in the West, and probably throughout the United States, and should be opposed to the limit. Joseph Vietti.

Ely, Nev.

By the Way

The Unimaginative Editor—Not Us

THE story of the New York bond man who saw in a bank of clouds at sunset only a replica of a chart of bond prices has been well matched in northern Ontario, says *The Wall Street Journal*. The editor of a mining paper was motoring a visitor from Cobalt to Kirkland Lake across a stretch of the clay belt. The visitor, a layman in mining, was admiring the beautiful views which appeared from each rise in the road. Coming upon a particularly charming prospect, extending for about 20 miles to a range of hills, he asked what were the hills in question. "Oh," said the mining editor without a moment's hesitation, "that is the end of the diabase."

* * * *

Why Mine Managers Become Gray-Haired

THE general manager of a mine in Mexico sends up this brilliant example of the trials that the "big boss" must endure. The writer holds a subsidiary position at one of the company's branch mines. Evidently, things are not going to suit him, and his opinion of his immediate superior is not of the highest:

Mr.——

General Manager
mining Co.

Dear Sir:

I have sent You a Telegram becaws Your presence is needed very much of cours much could haf ben avoided' if Your last stay would have ben long enough, but as it was I had no chanc to speek to You.

The trouble is that Mr. A——is not making any Progress on the Building, for the want of bolts and angel washers, and inexperience. I need the Building englosed befor I can asemble the Motor, I am so far advanced that I can practicalle do no mor, as I am held up everywhere for the want of something. if I asc for it, all thy say is, it is ordered long ego, Mr. B——allso puts every thing on paper, then looses it or forgetsit, He promised to send me the triplex-pump, Centrifucal-pump, D.C. Motor Lin shaft for Lathe. Gasolin Eng. ect, put nothing is coming, I am out of ciment, Lime, Bolts, Pipe, and Lumber, Pakings for Eng, I need the D.C. 220 volt Motor which thy have in the Mine to drive the Lathe, somebody told Mr. B—— that I could not use theme, put if they do not know thos things they should not mix in it, this is tetrimental to Your interest,

Mr. B——, and Mr, C——, wants to put the back side of Building in of Wood, in first place ther is no Wood her for it, put ther is plente of steel her, besides if this side is put in, as the intend, it will not stai ther 3 Months, on account of the sid being so large, and clos to Engine, that vibration produced from Engine willtherit to peaces, and this is dangerouse to Engine.

Water resorware is to be lowered, allso Oil tank needs to be lowered and many other things ar waything for You to pas on,

On all work her waste, inexperienc, is found plenty ful, I have led of haff of men some last frydai and some I will lay of Monday The rest we can arenge Verbally when YOu come.

Hoping that this is satisfactory to to You, I am yours,

Respectfully

NEWS OF THE WEEK

Summary

FORMATION of Minerals Division in the Bureau of Foreign and Domestic Commerce is announced by the Department of Commerce; will supplement and assist Economics Branch of the Bureau of Mines.

* * *

American Metal Co. closes its Joplin, Mo., office and will cease purchasing ore in the Joplin-Miami district; also, it is understood that the company will soon shut down its smelter at Blackwell, Okla.

* * *

Applications for concessions on land supposedly containing potash in the states of Coahuila and Chihuahua, Mexico, are made as a result of drilling done in Texas and New Mexico.

* * *

Department of Mines of Ontario, Canada, authorizes Sudbury Basin Mines, Ltd., to do geophysical prospecting on the company's claims in lieu of other work.

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The largest Dorr thickener ever built—325 ft. in diameter—has been ordered by the Miami Copper Co.; it will be used to dewater 12,000 tons of tailing per day.

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Construction of municipal works at the Noranda townsite progresses; water filtration and sewage-disposal plants should be operating before winter weather arrives.

* * *

Freeport Sulphur Co. leases the Big Hill sulphur dome of 675 acres, near Beaumont, Tex., from the Texas Exploration Co.

* * *

Phelps Dodge Corporation presents motion-picture evidence in the course of litigation concerning the infringement of the Carson patents.

Senator Oddie Makes Forceful Plea for Increased Appropriations

Chairman of Senate Committee on Mines and Mining Calls Bureau of the Budget Autocratic Institution— Government Guilty of Shameful Neglect

IN AN ADDRESS recently delivered before the Chamber of Commerce of Sacramento, Calif., Tasker L. Oddie, United States Senator from Nevada, and Chairman of the Senate Committee on Mines and Mining, forcibly called attention to the necessity for increased federal appropriations for the mining industry. Excerpts from the Senator's address follow:

There is a host of problems, technical and economic, affecting the mineral industries, which await study and solution and which require the attention of an impartial as well as a highly skilled staff of investigators. Vast reserves of iron ore, too low-grade to admit of utilization under present metallurgical practice, await the development of methods of concentration and beneficiation which shall add them to the nation's mineral assets. Metals having a value of millions of dollars are now being recovered annually from complex lead-zinc and lead-zinc-silver ores of the intermountain region that could not be worked at a profit a few years ago, and the recovery of additional millions of mineral wealth and resources awaits the findings of the research specialist. In the great Missouri-Kansas-Oklahoma lead and zinc district, which annually produces metals having a value of at least $50,000,000, research has already accomplished notable results in reducing milling losses amounting to roughly 35 per cent of the mineral in the crude ore. The development of a flourishing iron and steel industry on the Pacific Coast depends largely on the efforts of the technical investigator.

In northern Minnesota, immense tonnages of manganese, absolutely essential in the manufacture of steel, and therefore an urgent military necessity, are being marketed merely as a part of the iron ores in which they occur; intelligent research can without doubt liberate and utilize this indispensable mineral asset. The art of flotation, which, by increasing the mineral recovery from various classes of ores, has already added immeasurably to the nation's mineral production, beckons to the student who may develop the process to yet higher degrees of proficiency. While holding firmly the leadership of the nations in the production of minerals, the United States yet lacks adequate supplies of a few highly essential minerals, such as tin, platinum, potash, nickel, chromium, antimony, and nitrates. The finding of reserves of these necessary minerals, and the devising of methods of substitution, or of conservation of available supplies, furnish other fields for the investigator.

As the great bulk of the output of non-metallic minerals, including crushed stone, sand and gravel, building stone, slate and gypsum, and of such primary products as cement, lime, and plaster of paris, enter into the construction of buildings and roads, this output affects the life of virtually every community and every individual. The vast quantities of these materials used and the increasing call for economy in their use and for better service from them have resulted in a growing demand for technical research.

Problems of Vital National and International Importance

All of the problems which I have briefly outlined, and hundreds of others of vital importance, are of national, and even international, scope and importance. It is appropriate, therefore, that the scientists, engineers, and economists of the Federal Government direct their energies and skill toward the solution of these pressing problems of the mineral industries. The Federal Bureau of Mines has accomplished wonders with the small means at its command, and, through the employment of processes which the Bureau's technologists have developed or aided in developing, vast tonnages of mineral wealth are today being produced from sources which seemed hopeless a decade or so ago. The Bureau of Mines is, however, greatly handicapped by a governmental policy which has denied to the mining industry that measure of appropriations which are due so vital a part of the nation's economic structure.

The U. S. Bureau of Mines is the federal governmental agency representing the vast mining industry with its

practically 11,000,000 dependents, and its more than $5,000,000,000 of annual production. At the present time the total amount of money given this Bureau, for the period of one year, to forward the interest of the mineral industry is approximately $1,750,000. From a strictly dollars-and-cents viewpoint, the meager appropriations given the Bureau of Mines have been repaid over and over again in the form of mineral wealth saved to the nation through the stoppage of waste and in the way of new mineral wealth won from Mother Earth because of improved mining and metallurgical practice. From the standpoint of safeguarding the lives of that hardy legion which toils underground, the pitiful inadequacy of the appropriations doled out to the Bureau is even more pronounced. At present, the personnel of the entire Health and Safety Branch of the Bureau consists of about ninety men, and is but little larger than that of the Mine Inspection Department of the single State of Pennsylvania.

I wish to lay special emphasis upon the urgent demand that has arisen for reliable economic information regarding minerals. Only through government sponsorship can such information become generally acceptable as authoritative and wholly impartial. Yeomen service was long rendered to the mineral industries through mineral production statistics prepared by the U. S. Geological Survey and published in the annual "Mineral Resources" volumes. It was hoped that when this work was transferred to the Bureau of Mines in the Department of Commerce the scope of the work would be greatly increased, but, unfortunately, only slight new appropriations were made for this purpose.

Even as many miners die who might have lived had they received in time the safety instructions of the Bureau of Mines, so there are many business units of the mineral industry that make costly and often fatal mistakes through the lack of a clearing house of information on mineral economics. The farmer can ask of the Department of Agriculture any question regarding agricultural economics with assurance that the great department to which he has applied will be able to answer because of the ample appropriations with which it is provided. Why should not the producer of minerals receive the same consideration? If the productiveness of farms repays the nation the cost of such service to agriculture, can it be doubted that the increased assistance of the mineral industries would also be paid for by their increased prosperity?

Our mineral industry is of equal importance to our agricultural industry, although its annual production is only about $6,000,000,000—as against about $12,000,000,000 for the agricultural industry. The raw products of the mineral industry furnish over 50 per cent of the freight for our transportation systems. Our government is guilty of gross discrimination against—and a shameful neglect of—its duty toward the mineral industry. It provides annual appropriations for the agricultural industry of $128,000,000 and only about $4,000,000 for the mineral industry. Technical and economic research, and collection and dissemination of scientific data in aid of industry and enterprise, and the conservation and development of our natural resources have long been a fundamental policy of our government, yet the Bureau of Mines is allowed only about $300,000 for its economic research work, while the Department of Agriculture is allowed approximately $5,000,000—and even this sum is inadequate for the magnificent work it is doing. It is a shame and a disgrace for our government to violate its obligations toward our national welfare and safety as it is doing in this case. We rejoice in the powerful political influence the agricultural industry is able to wield in Congress and in our government. If the mineral industry were not so woefully lacking in numbers in Congress, there would be a totally different story to tell, and the result would be reflected in greatly increased prosperity to the agricultural, industrial, transportation, and all other industries in the country, as well as to the mineral industry itself.

Blames Bureau of the Budget for Inadequate Appropriations

No blame should be attached to the Secretary of Commerce, the Hon. Herbert Hoover, because of the lack of appropriations for the Bureau of Mines. He is a famous and able engineer, geologist, scientist, and executive, and keen for adequate appropriations for the carrying on of the work for the welfare and betterment of the mineral industry. Unfortunately, one branch of our government which is largely responsible for this condition is not functioning as some of us who helped to create it anticipated. I refer to the Bureau of the Budget. It is presided over by an able man, but it has gradually grown into an all powerful, and, in a sense, autocratic institution, usurping, in may cases, the functions of the body which created it—the Congress. It gages its actions by the standards and measurements of bookkeeping and cash balances, rather than those of public welfare and safety and of efficiency and results. It autocratically determines the amount of appropriations each department of our government can receive, leaving the allocation of the lump sum to the subdivisions of each department. It has sealed the lips of the various department and bureau heads so that they dare not ask Congress for more than it—the Budget—allows them, and has thereby deprived the government of the full initiative and efficiency it should receive from these men, many of whom are highly trained, able, and efficient business and professional men and scientists.

The Budget cannot seal the lips of any member of the Senate or the House, so I can speak my mind and am doing so freely. I have not been asked to make this plea by Secretary Hoover, or the Director of the Bureau of Mines, that able and efficient engineer and administrator, Scott Turner; or by Dr. George Otis Smith, that profound and famous geologist, the Director of the Geological Survey. I would not embarrass them by placing them in such a position. My practical knowledge of and experience in the mining field and conditions surrounding the various governmental activities having to do with the mineral industry are alone responsible for my interest in this matter. As chairman of the United States Senate Committee on Mines and Mining, it is my duty to bring this matter to the attention of the American people. It is their duty to use their influence to remedy this condition, of such vital importance to our country.

Public opinion will assert itself when it has been sufficiently informed as to the real conditions existing. By bringing these facts squarely before the people, we may hope for concerted, intelligent, and well-directed effort looking to their correction.

Ontario Authorizes More Geophysical Prospecting

FURTHER to test geophysical methods of prospecting for ore, the Ontario Department of Mines has had regulations passed by order-in-council whereby the Sudbury Basin Mines, Ltd., will thoroughly explore during the present year the extensive mining claims which that company has acquired in the township of Fairbank and vicinity. The proposition which the government is making to this company is practically the same as that under which the Hollinger interests are now making geophysical explorations in Kamiskotia.

According to the regulations, the money Sudbury Basin Mines expends on the geophysical work, computed at a set rate per day, will be allowed and recorded in satisfaction of the working conditions on the claims. If in the course of exploration, the company should locate favorable indications of ore deposits, it will be required to determine by diamond drilling whether commercial ore exists. All drilling is to be completed by Jan. 1, 1929.

Freeport Sulphur Co. to Develop Big Hill Deposit

Machinery and equipment for the development of a large sulphur deposit, situated at Big Hill, about eighteen miles southeast of Beaumont, Tex., are being received at the scene of the proposed mining operations. The Big Hill sulphur dome, comprising 675 acres, has been leased by the Freeport Sulphur Co. from the Texas Exploration Co., which was represented in the negotiations by H. Y. Staiti, vice-president and general manager.

The Texas Exploration Co., the par-

ticipating owners, acquired the property through lease in 1913, and, upon recommendation of Dr. William Kennedy, coastal geologist, now deceased, and Mr. Staiti himself, purchased the property in 1919. The Texas Exploration Co. drilled a group of six wells on the dome, on the south and southeast, but left the northern half of it practically untouched. Both Dr. Kennedy's and Mr. Staiti's report indicated promise of sulphur deposits. The Big Hill dome is quite similar to the Union Sulphur Co.'s dome at Sulphur, La., from which more than ten millions of tons of sulphur were recovered. The Sulphur, La., dome covers only 100 acres, it being less than one-sixth the size of the Big Hill dome. The Big Hill dome is three miles from Mayhaw Bayou, which empties into Taylor Bayou, the latter navigable to Port Arthur, 15 miles distant. It is planned to dredge Mayhaw Bayou and a canal to the dome that will be navigable to Taylor Bayou.

Mr. Staiti is president of the American Sulphur Royalty Co., and owner of the Freeport Sulphur Co.'s mines at Bryan Mound.

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Award Flower-Garden Prizes in Joplin-Miami District

PRIZES have been awarded in the annual flower-garden contest for mining plants in the Joplin-Miami district. First prize of $50 was won by the Blue Goose mine of the Commerce Mining & Royalty Co., the garden being planted and cared for by the superintendent, Frank Patrum. Second prize of $30 went to the Oklahoma Woodchuck mine of the Interstate Zinc & Lead Co.; third prize of $20 to the Lion mine of the Velie Mines Corporation; fourth prize of $15 to the Cherokee mine of the Interstate Zinc & Lead Co.; fifth prize of $10 to the Gordon mine of the Federal Mining & Smelting Co.; and sixth prize of $5 to the Grace Walker mine of the Commerce Mining & Royalty Co.

Besides the cash prizes there were numerous prizes of flower bulbs and seeds, contributed by local and other concerns. Additional mines that shared in these distributions on account of creditable gardens included the Commonwealth Mining Co., the Century Zinc Co., the New Chicago Mines Corporation, the Cortez-King Brand Mines Corporation, the Adams mine, the Golden Rod Mining & Smelting Co., the Skelton Lead & Zinc Co., the Black Eagle Mining Co., the Beck mine, and the Wilson mine. Honorable mention was made of twenty other mines which had good flower displays.

The prize list indicates the amount of interest evidenced in the contest, which was originated two years ago by Otto Shaner, a salesman for the Central Foundry, of Joplin, Mo. The judges this year included Richard Jenkins, secretary of the Tri-State section of the American Zinc Institute; W. G. Stevens, mining editor of the Miami, Okla., *Daily News-Record*, and James H. Wadleigh, mining editor of the *Joplin Globe*.

Liberty diggings and surrounding country

Galena Ore Strike Made in Kelly Gulch Near Hailey, Idaho

Rich Vein Discovered at Depth of Seven Feet—Extent of Deposit Undetermined—All Available Ground Posted With Claim Notices

ATTENTION of Northwestern mining men was focused on Hailey, Idaho, and the Wood River country a few weeks ago when Newton Matthews, Boise, Idaho, prospector, following a trail of floats and sulphide outcroppings in Kelly Gulch, 8 miles west of Hailey, discovered a vein of rich galena ore.

Faith in Wood River mining, which, with the closing down of the famous old Minnie Moore, from which millions of dollars were taken in galena in the early days, and with the suspension of development work on other properties, had sunk to a low ebb, rebounded as news of the Matthews strike spread. In a short time all the available ground in Kelly Gulch and vicinity was posted with mining-claim location notices. Owners of abandoned mines near the site of the strike are said to be watching the development work with interest and contemplating the reopening of their properties in event the newly uncovered vein proves to be of substantial size.

Mining engineers representing many of the largest mining corporations in the Northwest have visited the Liberty, as the Matthews claim is called, and the general opinion expressed is that the discovery is one of real importance. As yet the development work has not been carried far enough to reveal the extent of the orebody, but test and drill holes sunk at various places in the gulch indicate that the vein may be of unusual width and of considerable length.

A unique feature of the strike is that it was made in the bottom of a gulch and within seven feet of the surface. It appears that the general idea of successful prospecting in the district has been to open tunnels in the sides of the mountains. Such operations usually attained no depth greater than that of the level at which they were begun, unless an ore-bearing ledge happened to be encountered. If a profitable body of ore is proven in the Liberty, at a level that is hundreds of feet lower than the neighboring diggings, it may signify that previous operations had not been at sufficient depth to tap the main orebodies.

In common with many other finds the element of luck was more or less instrumental in the discovery of the Liberty. J. H. Matthews and his five sons, all of Boise, en route to a mining property in the Stanley Basin country in the spring of 1926, were forced to linger in the Wood River valley until the snow-blocked road over Galena Summit became passable. They pitched camp at Kelly Gulch and put in their time prospecting in that vicinity, making no startling discoveries but staking one mining location. In the spring of 1927 they began their annual pilgrimage to the Sawtooths unusually early in order to do assessment work on the Kelly Gulch claim located the previous spring. Completion of the assessment work found the Galena Summit road still blocked at a time when normally it would have been open. To utilize their time the Matthews party began prospecting in the vicinity of the first claim. One of the sons, Newton, while quenching his thirst at the creek, picked up a likely looking piece of float, and, despite the established precedent of drilling into side-hills, decided to sink a shaft near the creek bed. At a depth of

seven feet he uncovered the vein. Immediately everybody in the vicinity went on a location-notice posting bee, the Matthews party staking a total of fourteen claims.

The party has already received numerous offers from persons and corporations desiring to secure an interest in the Liberty claims. These offers, up to date, have been rejected. The present plan is to develop the property by sinking a shaft into the main orebody, then crosscutting to determine the actual width. This plan, it is believed, will result in sufficient data to give approximate ideas of the dimensions of the vein. The ledge is now opened for a distance of 95 ft., 45 ft. of which is said to show high-grade ore. The location of the property is favorable to winter development work. It is adjacent to the Hailey-Fairfield highway and the sloping hillsides obviate all danger of snowslides, such as several years ago resulted in destruction of property and the loss of several lives at the North Star mine, near Hailey.

Two of the best known mines in the neighborhood of the new strike are the Red Elephant and Croesus, both of

Ore ledge at Liberty claim

which are now closed. The Matthews plan to erect bunkhouses and continue the development through the coming winter—meanwhile the mining world is awaiting the results with considerable interest.

Engels Copper Mining Co. Reports Deficit

Engels Copper Mining Co., of California, reports a deficit of $4,257 for July, and $37,326 for the first seven months of 1927. In July $21,700 was spent in development and $134,051 for the seven months. The 11 level has been opened up. During July, 32,919 tons of ore was milled, with a production of 1,722 tons of concentrates. For the seven months' period a deficit amounting to $37,326 is reported.

American Metal Co. Closes Joplin Office

AFTER being one of the largest purchasers of zinc concentrates in the Joplin-Miami field for many years, the American Metal Co. has closed its Joplin office and will no longer be a factor in ore purchasing in the field. The company still owns several hundred acres of land in the Crestline, Kan., section and retains an interest in the Brewster mine, near Baxter Springs, Kan.

The American Metal Co. has been buying from 2,000 to 3,000 tons of zinc concentrates every week in the Joplin-Miami field, shipping it to the company's smelters at Blackwell, Okla., and Langeloth, Pa. It is understood that the Blackwell plant will be closed on account of a shortage of natural gas, which is used for fuel purposes.

Quincy Entering New Rich East Vein at Depth

Progress Made in Pumping Operations at Calumet & Hecla Consolidated's Cliff and Phoenix Mines

IN THE Michigan copper district, Quincy's production is approximately 60 per cent of what it was before the fire damaged No. 2 shaft and put it out of operation. No. 6, in which production has been speeded, is shipping about 1,200 tons of rock per day, compared with an average of 2,000 tons for the two shafts before the fire. Some work is being done in the bottom levels of No. 2, where openings are being driven in four faces. Repair of No. 2 is going forward steadily with three shifts of timbermen on the work. The cost of reconditioning No. 2 will be considerable, but, with the development of the new, rich East vein at depth, a new era should be opened for Quincy. The lode is wide and heavy with copper, its richness having proved constant and uniform.

Good progress is being made in pumping operations at Calumet & Hecla Consolidated's Cliff and Phoenix mines, in Keweenaw County, which will be used for exploratory purposes. However, some time will elapse before the shafts are dewatered. At Cliff, the Avery, which will be used as a pump shaft, has been drained, and pumping has started in No. 4, which will be the operating shaft. Numerous levels and crosscuts from this shaft will prolong the dewatering process. At Phoenix, pumping is proceeding in an incline shaft, east of the Crocker, with which it is connected. The combined depth of these shafts is 1,500 ft.

The Wyandot Copper Co., the affairs of which will be wound up and the company dissolved, started work in the Michigan district in 1899, largely on the Winona formation. Subsequently, efforts were made to locate the southerly extremity of the Baltic and Lake lodes. It has two shafts approximately 1,000 ft. deep and fairly well equipped and nine other shallow shafts or pits sunk for exploratory purposes. Results were negative. The company has 1,065 acres adjoining Winona.

Removal of five boilers from the old Centennial-Allouez stamp mill at Point Mills to the Isle Royale mill probably means the abandonment of the Point Mills plant, so far as stamping of rock is concerned. Calumet & Hecla Consolidated has ample stamping facilities in its mills at Lake Linden and Tamarack Mills. Only the Calumet mill at Lake Linden is now operating, the Hecla plant being idle. The boilers being removed from Point Mills will replace those in use at the Isle Royale plant.

Mayflower has resumed crosscutting in a westerly direction from the 1,700 level of its shaft. The drills are in trap rock. Work will be pushed in the hope of opening an amygdaloid deposit of commercial value. Drifting in the most promising of the veins encountered by the crosscut has been abandoned, the lode proving narrow and lean.

The hoist from No. 1 Allouez shaft is being moved by Calumet & Hecla Consolidated to Ahmeek No. 2 shaft; it will provide a lifting capacity of 5,000 ft.

Motion Picture Evidence Used in Carson Case

During the litigation on the Carson patent infringement now being carried on in the Tucson, Ariz., courts, three reels of motion pictures were offered in evidence by the Phelps Dodge Corporation, one of the defendants in the suit. It was said that the views of the furnace were taken while the interior was at a temperature of about 2,500 deg. F., and that the plate glass windows between the furnace interior and the camera frequently cracked from the intense heat and had to be replaced.

The defendants insist that the Siemens furnaces, which according to the evidence are used by the Phelps Dodge Corporation, are not blast furnaces. They lack one essential element of a blast furnace, in that they have no "blast." They also contend that singly, and co-jointly, the principle of side charging was anticipated long before Carson filed an application for a patent. Associated with the Phelps Dodge Corporation in the defense is the Calumet & Arizona Mining Co.

Miami Copper Places Order for 325-ft. Thickener

Miami Copper Co. has ordered from The Dorr Company the largest Dorr thickener ever built. This thickener will be 325 ft. in diameter, providing almost two acres of settling area. The unit will be used for dewatering 12,000 tons of mill tailing per day before the tailing is laundered to the tailing dump three miles distant.

Formation of Minerals Division Announced by Department of Commerce

Part of Bureau of Foreign and Domestic Commerce—
Will Supplement and Assist Economics
Branch of Bureau of Mines

By Paul Wooton
Special Washington Correspondent

THE Department of Commerce has been surveying and co-ordinating its activities in the field of minerals and metals, to the end that these industries may be able to obtain through the department's facilities a broad international perspective. The economic structure of the post-war business world necessitates in practically every industry careful and constant study of world-wide conditions, and this is especially true of the minerals and metal industries.

Three Sections in New Division

To render more efficient service in this direction the first step has been the formation in the Bureau of Foreign and Domestic Commerce of a Minerals Division, which will supplement and assist in the work of the Economics Branch of the Bureau of Mines. This division, the nucleus of which is the former Minerals Section of the Foreign and Domestic Bureau's Iron and Steel Division, comprises three sections: Coal, Petroleum, and Minerals and Metals, each in charge of a specialist in these commodities.

The Minerals Division has been charged with the development and promotion of foreign trade in minerals and metals and their primary products, and is responsible for the collection, compilation, and dissemination of current foreign trade information. Its mineral and metal marketing specialists are the connecting links between these industries and the Bureau of Foreign and Domestic Commerce's sources of information and services throughout the world, including fifty-one Bureau foreign offices and four hundred thirty-eight United States consulates. The Bureau's fifty-seven district and co-operative offices in the principal cities of the United States serve to keep the American manufacturer and exporter in more direct touch with the Bureau at Washington.

Services More Readily Available

Domestic mineral and metal industries also have at their disposal in the Bureau of Foreign and Domestic Commerce several special services which will now be more readily available to these industries through the Minerals Division. For example: The division of foreign tariffs advises concerning the customs duties of different countries and import and export regulations. Bureau experts in commercial law collect information concerning commercial laws of foreign nations, including the laws and rules relating to mining and industrial property. The finance and investment division keeps in close touch with the financial situation in all countries and is in a position to supply data concerning foreign investment opportunities. The division of statistical research collects trade statistics of foreign nations, and the division of statistics, in co-operation with customs officers, collects and compiles for publication statistics of the import and export trade of the United States. Finally the transportation division compiles and furnishes information on foreign and domestic freight rates and packing methods, and the commercial intelligence division provides lists of foreign importers and firms which are interested in American materials and maintains detailed reports on more than 300,000 foreign merchants and manufacturers.

Researches to Be Expended

Aided by the department's foreign offices, the specialists and engineers of the Economics Branch of the Bureau of Mines will expand its researches into world-wide mineral occurrences and productions. Its several divisions specializing in coal, petroleum and other minerals, both metallic and non-metallic, will continue to make studies of the economic problems of the mineral industries of the country and endeavor to aid in their solution. The Economics Branch will likewise carry on its studies and investigations into domestic resources, volume of production, consumption, distribution, stocks, commercial uses, trade conditions, and similar subjects, and will continue to collect and disseminate statistical data relating to all of these subjects.

The minerals and metal industries of the United States also have at their disposal in the Department of Commerce several other services, each specializing in an important phase of these industries. The Bureau of Mines, Technologic and Health and Safety Branches, the Bureau of Standards, and the Bureau of the Census function in this field.

Naturally, the Bureau of Mines is most important and is undoubtedly best known to the mining industry. It is the province of this Bureau to study the methods of producing, treating, and utilizing ores, mineral oils, gases, and other mineral substances. The purpose is to reduce or prevent waste in the mining, quarrying, metallurgical, and other mineral industries and to conserve the country's mineral resources. Its specialists in technology make special investigations of the cause and prevention of mine explosions and major mine accidents. Its system of approved electrical devices directs attention to safe machinery for mining purposes. Its metallurgists and groups of eleven experiment stations and thirteen field offices in various parts of the country offer service in studying complex ores, the beneficiation of low-grade ores, and the elimination of waste in metallurgical processes. The Health and Safety Branch directs a service of instruction in safety methods and mine rescue in case of disaster, through a system of five field offices and eleven well-equipped railroad cars carrying specialized apparatus and skilled crews. This is supplemented by a system of ten fixed stations from which mine rescue trucks give similar service. Its safety specialists investigate safety practices in mines and offer reports thereon when requested. Its surgeons make special studies of health conditions in mines and the special health hazards of the mining and metallurgical industries.

Functions of Bureau of Standards

The basic function of the Bureau of Standards is to establish and maintain national standards of quantitative measurement, although substantially half of the resources of this Bureau are expended in the testing of materials, instruments, and equipment. Its metallurgy division has for its function investigational work with metals and alloys to determine their structure and behavior under various conditions and to establish specifications for standards of metals and alloys and determine their metallurgical constants and properties. It conducts investigations looking to improvement of metallurgical processes, such as annealing, tempering, casting, and welding. Its clay and silicate products division makes investigations into the principles involved in the manufacture of clay and silicate products, including tiles, porcelain, glass, and cement. It investigates also the construction of refractories and the enameling of metals. It determines the formulas and specifications for standard qualities of such materials. Its division of simplified practice aids the various industries to standardize, as far as practicable, the grades, types, and sizes of the commodities which they produce for market and the nomenclature applicable thereto, in order to reduce and eliminate wastes which result from excessive variety.

Industry Should Take Initiative

Periodically the Bureau of the Census obtains and records special statistics of interest to the minerals industry, such as data pertaining to the country's mines, quarries, refineries, manufacturers, and other industrial factors.

The Department of Commerce invites the minerals and metals industries to utilize its economic and technologic services to the fullest degree. Industry, however, should take the initiative in making its special needs known to the department.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Construction of Municipal Works Progresses at Noranda

TORONTO, SEPT. 17—The townsite of Noranda, which was thrown open to the public just about four months ago, is showing much progress. More than 100 men are employed on municipal works; water mains and sewers have been laid, and streets and roadways extended. Sidewalks are being put in on the main thoroughfares and the water filtration and sewage disposal plants should be operating before the winter. The Horne Copper Corporation plans to erect fifty houses for the company's employees, about twenty now being in course of construction. Two banks have good buildings under way. A record was made recently when in two days building permits were issued for $100,000 worth of municipal construction.

The new discovery on the 1,000 level of the Barry-Hollinger mines, at Boston Creek, is more than living up to expectations, and the management states the find is the most important in the history of the property. The work on the crosscut which led to the find was started only three months ago. The mill resumed operations this week, and, with the new additions, will have a daily capacity of 200 tons. For the present, however, it will treat only 150 tons a day. The management took advantage of the recent shutdown to fill the stopes.

THE office of N. A. Timmins appears to dominate the Amulet situation. Mr. Timmins is known to be a heavy stockholder in the property and has always had great faith in its ultimate possibilities. It is understood that K. A. MacPhadyen, who has done good work at the property, will be leaving in a few months and will devote his time to an exploration campaign in a new and promising section of northern Ontario. No definite announcement has been made of any new financing, although there have been rumors concerning the matter for some time. It is becoming evident that Amulet mines will have sufficient ore to justify the erection of its own concentrating mill.

Officials of the Ribago mines state that the mining plant for the property has arrived and is now being installed. Present plans call for shaft sinking at the rate of more than 100 ft. a month, two shifts being used in the work. A geological survey, including dip-needle prospecting, has been made during the last few months with encouraging results. One zone near the Thormoor line has been trenched and stripped, revealing a mineralized area 300 ft. wide and at least 500 ft. long. Four veins have been uncovered in this zone, and prospecting shafts, 25 to 50 ft. deep have been sunk on each vein. All of the shafts are in a good grade of copper ore carrying fair gold values. The plant being installed includes a four-drill compressor which will be used in the development work planned. It is proposed to continue No. 2 shaft to depth, to cut a station at 75 ft., and to crosscut to No. 1, No. 3, and No. 4 veins to determine their dip.

An interesting situation is developing on the surface discovery made three-quarters of a mile east toward the Vickers line and close to a diabase dike. Trenching has been started on this showing, and in the first pit the vein of chalcopyrite was 6 in. wide on the surface and at 10 ft. widened to 4½ ft. Stripping has been carried on for 700 ft., and surface trenching is being continued. The Ribago is well financed to carry out the work planned for the next year.

Don Rouyn mines has discovered a body of chalcopyrite at a depth of 58 ft. in the shaft now being sunk by hand on the property. Also, a mineralized zone 2,000 ft. long and 600 ft. wide has been uncovered by drilling and surface work. Values were generally disseminated, but in places have been found concentrated. If shaft-sinking results continue interesting, the directors will consider the installation of a plant and the expansion of development operations.

Kirkland-Hunton mines is opening up encouraging values in drifting on the 675 level. To this date 40 ft. of good-grade ore has been encountered. This drift is toward a diabase dike, which runs south from the Teck-Hughes, and it is at this point that best indications are expected. The dike is still about 300 ft. from the drift face. A crosscut has been started to the northwest on the 675 level to intercept a fault at the north end of the property.

Arrangements have been completed by Porcupine Crown mines to resume work on the company's property in Guyenne Township. Horace Strong has been appointed consulting engineer and Mr. Bischoff resident superintendent. A contract has been placed for 2,000 ft. of diamond drilling. Some months ago a pronounced mineralized break was found by a dip-needle survey, and exposures were located determining its lateral extension for at least 1,080 ft.

Announcement has just been made that the Grover-Daley Mines, Ltd., will take over Dupuy mines, which holds property in the Abana and Laval section of Quebec; an official statement regarding terms will be issued soon.

Dunlop Consolidated is obtaining interesting results from its claims in Montbray Township. On claims west of Nipissing, exploration has encountered good gold values with galena, silver and some copper.

Stadacona mines now has two drills working on the company's No. 8 and No. 11 properties. On the No. 8, the drills have intersected a sulphide zone at a depth of 250 ft.

London Letter

BY W. A. DOMAN
Special Correspondent

Groups Holding African Copper Concessions Sanguine

LONDON, SEPT. 13—In mining circles the principal topic of conversation is base metals, particularly copper and tin. As regards the former, Rhodesia is well to the front, and those holding concessions, mainly of course the Edmund Davis and Chester Beatty groups, are sanguine as to the future. On a former occasion it was mentioned that the opinion prevailed that from the lie of the deposits they constitute a continuation southward of the great Katanga beds. Further development is said to confirm the view, and though some years may elapse before any substantial contribution is made to the world's output of the metal, no doubt is entertained that production will be great. While prospecting and development are in progress the question of treatment is not overlooked. This matter is taken all the more seriously by reason of the failure of the Bwana M'Kubwa to come up to expectations. That it will do so in time there is little doubt, but that there is great disappointment is also unquestioned. Companies already at work will need further capital, and it is the delay in fulfilling promises that upsets investors. P. K. Horner has not modified his conclusions unless they have become more favorable, and finance houses are banking on him. Some shares have tumbled rather heavily in price, and yet are being held for an even higher figure.

TIN has not yet been able to climb back to the £300 per ton mark, and as a result the share market is quiet. So far this year the quantity of the metal exported from the Federated Malay States is 33,527 tons, against 30,295 tons in the same period of 1926 and 30,998 tons for the first eight months of 1925. Great hopes are entertained of the future of the Kagera (Uganda) Tinfields. R. A. Archbold, who has visited the property, reports that at the Mwirasandru mine the tin deposit is remarkably rich. He plans to sink a line of boreholes across the valley to test the presence of alluvial tin. At first it was thought that costs at this property would be so high as to be almost prohibitive, but so far as transport is concerned there are good roads, and little trouble is expected.

Copper Exporters, Inc., seems to be having matters much its own way, though there is a certain amount of grumbling that the price at which European consumers can obtain copper is above that at which Americans get their supplies. The result is that there is little forward buying here, merchants confining themselves to immediate needs.

Mexico City Letter

By W. L. Vail
Special Correspondent

Potash Concessions Desired as Result of Drilling Across Rio Grande

Mexico City, Sept. 14—Applications have been made recently to the Department of Mines for concessions on supposed potash deposits in the states of Coahuila and Chihuahua. Interest in these deposits was aroused by recent activities on supposedly similar lands across the Rio Grande in the states of New Mexico and Texas. It is understood that a local company on the border has been organized to prospect the Mexican concessions.

The situation at the Amparo mines, in the State of Jalisco, remains more or less as previously reported, with the exception that the American chargé d'affaires in Mexico City, Arthur Schoenfeld, has made another request on the Mexican Foreign Office for Military protection of the American and British officials who have remained at the mines. Troops were sent to Amparo several days ago, but were removed in order to chase bands reported near San Marcos. The American representatives want to have troops stationed permanently at the scene of the troubles until all pending differences are settled, and because of a fear that anti-foreign riots may be precipitated by the "Red" elements.

VACAS mines, in Durango, are being reopened by the McCaughn Investment Co., situated in the city of Durango. Erection of an electric plant of 400 hp. and a mill for the treatment of the rich zinc and lead ores is being considered. It is stated that Moffet & White, Inc., of Los Angeles, are financing the work.

Cia. Minera Chontalpan y Anexas, in Guerrero, has increased its capital stock by the issue of 4,000 shares which have been placed on the market, shareholders preferred, at 30 pesos per share. The issue was oversubscribed at once. Although the company has an ample reserve fund, the increase in stock was considered advisable for the purpose of completing the construction of a flotation plant, which, it is hoped, will be ready by the end of October, and the 150-ton mill, which probably will be operating by the end of the year. The company reports 400,000 tons of ore blocked out, which, it is claimed, will furnish a profit of 40,000 pesos monthly.

Word from El Oro, in the State of Mexico, is that the Esperanza and El Oro Mining & Railway Co. are selling off their machinery and that both mines are being flooded and the pumps taken out. The mines were efficiently worked, but the values at last have been exhausted. Mexican Mines of El Oro is still working some small veins and is experimenting with the re-treatment of tailings, of which an enormous tonnage is available. So far it has been impossible to secure results that would warrant treating the tailings on a practical scale.

Dos Estrellas continues to work a number of small veins in Tlapahuala in order to enrich the ores which are being put through the mill. The veins vary in width from 1 to 1½ meters. Dos Estrellas hopes by these methods to be able to carry on for a time without actual loss, but without much expectation of profit. Operators at the Lane-Rincon mines, at Temascaltepec, State of Mexico, have been worried considerably by isolated bands of bandits, but it is reported that the marauding parties have recently been driven over the state border into Guerrero by federal troops. The work of development subsequently was resumed. Adjoining properties have recently been taken over under working leases. A number of small properties are being worked in and around Sultepec.

The old Peñoles mine, now known as the Jesus Maria, located between Mapimi and Parral, has been closed because of the low price of metals. The Peñoles was working under a twenty-year lease to T. Skewes Saunders and S. W. Atkins. It is an old property and was actively worked twenty years ago. It carries high-grade silver, lead, and zinc ores.

The European directors of the Santa Gertrudis mines, of Pachuca, express satisfaction at the state of affairs at the mine, after a careful examination of conditions. They report a large quantity of reserve ores containing good silver values. The former average recovery was maintained during the entire past year.

Tenabo Consolidated Enlarges Plant

Two carloads of concentrate have been shipped from the Tenabo Consolidated Mines at Tenabo, 24 miles south of Beowawe, Nev. These shipments carried $94 and $70 a ton in gold. The company has decided to augment its equipment by installing another flotation cell and dewatering equipment. Working three shifts a day, the new plant has a capacity of fifty tons per day. At present, operations are on a basis of two shifts.

Central Manitoba Receives Hydro-Electric Power

Hydro-electric power is now available for the Central Manitoba gold field. The finishing touches have been placed on the 50-mile transmission line from Great Falls. The line runs southeast from Great Falls to the Central Manitoba mine, northeast of Long Lake. Eldorado Gold Mines, Ltd., has built a three-mile branch line connecting its property with the main transmission system. This line is also ready for work.

Johannesburg Letter

By John Watson
Special Correspondent

Gold Producers' Council and Workers' Union Sign Agreement

Johannesburg, Aug. 23—An agreement was signed last week between the gold producers' council of the chamber of mines and the mine workers' union to abide by a new method of procedure. Employees may now have access, through a defined channel, to discuss with the company's directors any matter in dispute, except the employer's freedom of action in regard to individuals. The agreement has been welcomed by the miners' organizers as a definite improvement indicating a more friendly relationship.

A rush to peg claims for diamond digging took place at Welverdiend, 14 miles from Lichtenburg, on Aug. 16. The farm is one of 4,000 morgen, and about one-fifth of this area was available for pegging by the runners. (A morgen is equivalent to 2.17 acres.) About 400 mounted police drawn from various parts of the Union were on duty, clearing the ground to be proclaimed and keeping the crowd in order. Mining Commissioner Jack read the proclamation, and when the flag fell about 5,000 runners stampeded over the sun-dried veldt, raising clouds of dust as they raced along. There was at least one girl among the runners who succeeded in pegging a claim, notwithstanding the confusion and keen competition.

MAY MORN gold mine, situated on the well-known Sheba farm, in the Barberton district, was sold by auction in Johannesburg on Aug. 16 for £1,250 to the Sabie Gold Mining Co., Ltd.

At a recent meeting of Falcon Mines, Ltd., of Southern Rhodesia, shareholders were informed that their predominant partners in the option over the Wanderer mine had decided to abandon the option on the terms formerly offered. Work is progressing at the M'Tugwa mine, which was examined and reported on a year ago by Dr. Malcolm Maclaren, and which was acquired by the Falcon Mines, Ltd., for £25,000 in cash. However, this work has not as yet reached the stage at which the probable extent of the mine or its potentialities can be definitely determined.

A digger near Christiana recently found a diamond of 23½ carats in the Vaal River. The stone was of a yellow shade, but realized £300. On Aug. 18, at Higg's Hope, a 70-carat diamond of rare quality was found and valued at about £2,000. Another, of 121 carats, was found the same day valued at £1,200. These were dug out of the face, one by a native and the other by a European employee. During the same week, stones of twelve, eight, and five carats were also found.

Societies, Addresses, Reports

In Canada With the British Empire Mining Congress

By A. B. Parsons
Associate Editor

En route, Victoria to Vancouver, B. C., Sept. 15—After an exceptionally pleasant social visit to Victoria, the Empire Mining Congress is aboard the steamship "Princess Alice" en route to Vancouver, via Britannia Beach. A technical session tonight, a round of sightseeing followed by official Banquet No. 4, at the Vancouver Hotel, tomorrow, and the return journey eastward will start. Concerning these I shall write in a concluding letter next week. In the present article I shall tell something of the visits at the Trail reduction works of the Consolidated Mining & Smelting Co. at Tadanac, and at the mine and concentrator of the Granby Consolidated Company at Allenby, which, by the way, should not be confused with the operations of the same company at Anyox.

The Trail Reduction Works

The Trail plant unquestionably is the outstanding non-ferrous metallurgical enterprise in the British Empire, if not in the world; and it is unique in that it produces in large quantity and in final refined form the following metals: copper, lead, zinc, silver, and gold. In addition, a small unit for the production of electrolytic cadmium recently has been constructed, and there is the probability of producing tin and bismuth. The Sullivan ore contains some tin and bismuth as a constituent of several of the custom ores received at Trail. Most of the copper comes in the form of concentrate from the Granby operations at Allenby. The chief source of lead, zinc, and silver is the company's own Sullivan mine, but small companies are important contributors. The following table shows the current daily production of refined metals:

Lead, tons	400
Zinc, tons	280
Copper, tons	60
Silver, oz.	20,000
Gold, oz.	100

So far as lead is concerned, the furnace capacity is fully 600 tons per day. It may also be remarked that the Sullivan mine and mill could readily increase output from about 3,600 to 4,000 tons per day. It is reasonable to infer that the prevailing condition of the markets for lead and zinc, and the current high rates of world production, are the reasons for not doing so.

As is usually the case where a smelting and refining plant is operated along progressive technical lines, changes are constantly being made at Tadanac. The program of expansion likewise entails new construction. Some of the new work of this character done recently includes the following:

1. Extension of the Zinc Plant—This work entailed the installation of six new Wedge roasters, making twenty-three in all. These have seven hearths, 25 ft. in diameter, with air-cooled rabble arms. The operating temperature ranges from 1,200 to 1,350 deg. F., and the gases and fume go to a plate-type Cottrell treater. The leaching plant was

S. G. Blaylock, general manager, Consolidated Mining & Smelting Co. of Canada

The Host at Tadanac

enlarged, the most important single addition being a large steel building in which have been installed nine new Dorr thickener tanks, 50 ft. in diameter and 12 ft. deep. These are wooden tanks with a square wooden shaft and rake arms and rakes of wood. The leaching is a double process with both acid and neutral circuits, calcine and zinc dust being used for purification. The new thickener tanks are for handling the pulp from the Pachuca agitators in the acid circuit. One sees here an installation as big as many complete mills, required for performing a single step in a process containing a dozen steps.

New units have been added to the tank room, including five 2,500-kw. rotary converters, one of which is a spare. There are in all 2,340 cells, each containing 17 lead anodes and 16 aluminum cathodes. The current density is 30 amp. per square foot, and the voltage drops about 3.6 volts between cells. The electrolyte contains 150 grams of zinc and 135 grams of free sulphuric per liter.

2. Copper Reverberatory Furnace—Instead of the old blast furnaces, a new reverberatory is now being used to smelt the copper concentrate from Allenby. To the raw concentrate, containing 10 per cent moisture, enough old sulphide mill tailing is added to provide sulphur for a 40 per cent matte. The concentrate contains about 29 per cent copper and 16 per cent sulphur. Features of the smelting are the small size of the furnace—only 60 by 18 ft.—and firing with coal, pulverized by the Hardinge "unit" system. There is no storage of pulverized coal, the mill supplying fuel only as needed. The slag contains 40 per cent silica, 21 per cent iron, and 11.5 per cent lime. About 300 tons of charge per day is smelted.

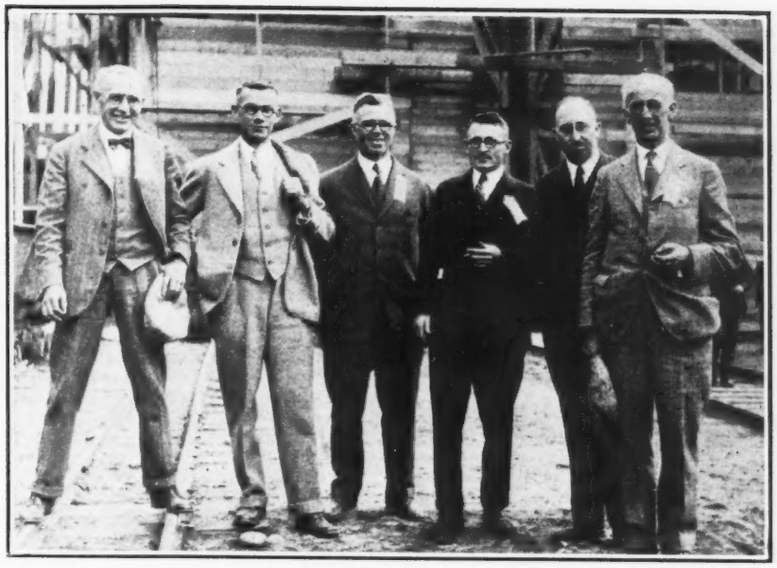
3. Cottrell Treater for Dwight-Lloyd Sintering Machines—The use of wood as the structural material for both the Cottrell treater and the flues leading to it is a novel point in the sintering department of the lead smelter. Because of the high humidity required to effect a good clearance, corrosion of metals is excessive. Ordinary plank laid in laminated fashion and "gunited" on the outside has proved satisfactory, thus far at least. The treater is of the plate type, with 8-in. spacing. A double treatment is used to make a sinter that constitutes the entire blast-furnace charge except for coke. The charge to the primary machines comprises concentrate, zinc-leach residue, flux, and a little slag. The feed contains about 45 per cent lead and 15 per cent sulphur; the product about 8 per cent sulphur. This is crushed and mixed with sufficient slag to assure the making of a good sinter from a mechanical standpoint, and run over the secondary machines, on which the sulphur content is reduced to 1½ per cent or lower. Beds as thick as 10 in. are made on the secondaries.

4. Electric Smelting of Zinc-Leach Residue—At present the residue from the leaching of roasted zinc concentrate goes to the lead smelter; but, as it contains about 15 per cent zinc in addition to 9 per cent lead, the procedure is far from satisfactory. An electric furnace, consuming 1,500 kw., has been installed to carry out, on a small scale, an alternative treatment for these residues. The tentative plan is to fume the lead and zinc as a "blue powder," which is to be leached.

5. Cadmium Recovery—Precipitates from the purification of the pregnant liquors going to the electrolytic department of the zinc plant have been stored, pending the erection of a unit to recover the contained cadmium. This, I understand, is nearly ready for operation. The scheme is to leach with sulphuric acid, and precipitate by electrolysis as used for zinc.

6. New Machine Shop—A splendidly constructed and lighted building to serve as the machine shop has just been completed. It is 64 by 212 ft., of steel construction with "gunited" exterior. The Consolidated company uses the cement gun very extensively, and has developed a practice of its own. The aggregate is screened only to pass a half-inch mesh and is not dried. Results are highly satisfactory. Incidentally the company is equipped to make almost any kind of machinery or repair parts. For example, in one month 244 tons of castings were made, one casting weighing nearly 14 tons; 52 tons of chilled cast-iron grinding balls are made each month.

The foregoing are a few of the interesting facts that I was able to obtain in a very hurried journey over the 160 acres that the Trail plant covers. As one engineer remarked, a person could spend a month at Tadanac and then have only a very general conception of all that is being done. A remark of another engineer whose home is in Great Britain may be worth repeating. He said: "These fellows have a big advantage, it seems to me, because of the relations between the workers and the bosses. The superintendents seem to think that the operators have heads on their shoulders and consult with them instead of giving orders as if they themselves were the only ones that knew anything. One trouble with us on the other side is that we don't teach our workers to take any responsibility." This may be an exceptional view; at any rate the speaker apparently noted the excellent morale at Trail.



Left to right—J. Buchanan, smelter superintendent; E. M. Stiles, chief engineer; B. A. Stimmel, zinc-plant superintendent; George Murray, assistant smelter superintendent; R. W. Diamond, superintendent of concentration; T. W. Bingay, comptroller

Officials of Consolidated Mining & Smelting Co.

The Allenby Mine and Mill

The Congress entrained at Trail after lunch on Monday, and late the next afternoon reached the Allenby mine of the Granby company. The members were met by H. C. Smith, general superintendent, and J. A. McLaughlin, mine superintendent. Not until 1925 was this property ever operated for any extended period, although a mill was erected and run for a time in 1920. In 1925, soon after Charles Bocking assumed the general managership for Granby, the mill was thoroughly revamped, and with the addition of more machinery, recently, has been brought up to a capacity of 2,500 tons per day. The ore is comparatively low in grade, and because of the presence of numerous barren dikes in the mining area it is difficult to maintain the mill heads above 1.5 per cent copper. The necessity for very fine grinding adds to the cost of milling, but operations, nevertheless, are said to be returning a slight profit at current prices for copper.

Left to right—Jack McLaughlin and H. C. Smith

Mining is done by a sort of combination of surface and underground glory-holing. In the lower portions, inclined spiral raises are driven 25 to 30 ft. wide and sloped so as to make a 200-ft. ascent while making three complete turns around a central core 30 ft. in diameter. The core is subsequently undercut and attacked on the side if necessary so as to leave ultimately a hole or "stope" about 90 ft. in diameter. Such holes are connected with each other, or with surface glory holes, as conditions make advisable. Remarkably low costs have been attained, the most serious difficulty being the dilution arising from the presence of the dikes. A sorting belt is now being installed to help remedy this.

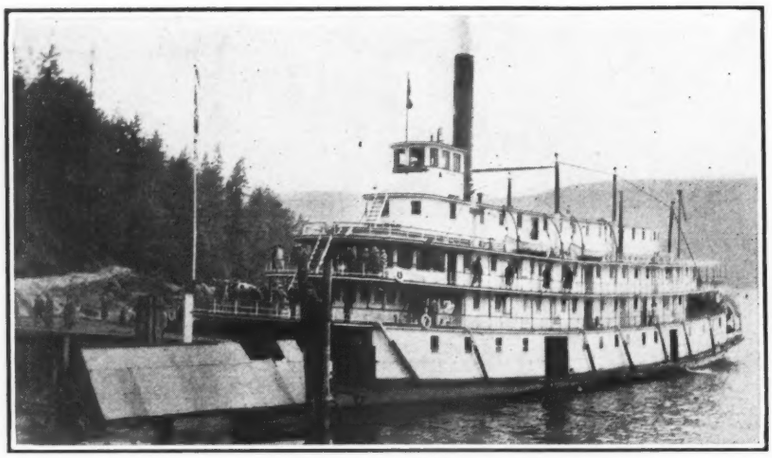
After a dinner that lived up to the usual high standard set by all the mining companies that entertain the Congress, the visitors returned to their train, and on the way back to Princeton stopped for a half hour at the concentrator, which is 8 miles below the mine. H. R. Taylor, mill superintendent, and his staff, made good use of the time they had. Two-stage grinding and regrinding of the middlings from the flotation cleaners; double classification; and floating in cells of the Inspiration type with xanthate and pine oil is, briefly, the treatment at the plant. Here again careful attention to detail has made possible a creditable record as to costs.

This and That

CONTEMPLATING the rather lean looking ore—much of it assaying less than 1.5 per cent copper—that the Granby Consolidated is exploiting at a small profit at its Allenby plant, B. Lightfoot, government geologist from Rhodesia, remarked: "I think that I shall recommend putting the whole of Rhodesia through a mill."

* * *

Australia's representation is small, but as they—the delegates—admit, very select. Charles J. Morris, of Melbourne; E. C. Andrews, of Sydney, and Mr. and Mrs. G. C. Klug, of Kalgoorlie, make up the list. Mr. Andrews is well known for, among other things, his detailed geological report on the Broken Hill area made in 1922. He is willing to go on record as forecasting that Broken Hill, which already has produced $750,000,000 in lead, zinc, and silver, will produce as much more in the next forty or fifty years. Mr. Klug, as representative of Bewick, Moreing & Co., is interested in the Zinc Corporation, Sons of Gwalia, and Oroya Links companies, as well as others. He is also a director of the Electrolytic Zinc Corporation. He calls attention to the fact that James Lyster, at Broken Hill, first made a successful separation of lead and zinc by flotation. In fact, he feels that Australian



C.P.R. steamer "Nasookin"

The Congress Lands at the Bluebell Mine

engineers are not always given the credit that they deserve in connection with the development of flotation. Bradford, Freeman, Seale, Shellshear, and Hibbard are among those that Mr. Klug mentions as having contributed much to flotation. Mr. Klug likes to talk about Australian mining, and he is an interesting conversationalist.

* * *

Incidentally, Mr. Klug was the first speaker to make formal recognition of the presence of the ladies. He paid his respects quite gracefully at Winnipeg, after dozens of others had had the opportunity and failed. His popularity among those of the fair sex may be imagined.

* * *

C. J. Stannard, mining and metallurgical engineer of London, after visiting the electrolytic zinc plant at Trail, recalled how he had been retained more than twenty-five years ago to investigate the Ashcroft process, then being experimented with by the Sulphide Corporation in Australia. He concluded that the problem of roasting lead-zinc ores, the high cost of electric energy, and the difficulties attendant upon the pumping, thickening, and filtering of hot acidulous liquors and pulps made it doubtful if the process could be carried out profitably. He was impressed with the remarkable success with which these problems have been solved by modern metallurgy. The Consolidated only recently won a decision in the courts based on the contention that the company's process is essentially that of Ashcroft and consequently does not infringe upon the French process.

* * *

A. S. Lillburne operates the only gold mine in the Federated Malay States. It is called the Raub Australian Gold Mine and is situated about midway between Singapore and Penang. Though the property has produced £2,000,000 and has been in operation for 32 years it had not paid a dividend until recently. The most interesting thing about the operations is the fact that earnings were increased by reducing the output from 100,000 tons per year to 20,000. The grade of the ore before Mr. Lillburne took charge in 1920 was about 0.2 oz. per ton. Sixty per cent of the material sent to the mill was really unpayable. By the introduction of selective mining, the heads were raised to 0.5 oz. Numerous measures of economy included improvements in the hydro-electric plant and in the transmission line from the plant to the mine, the addition of a cyanide plant to treat the tailings from amalgamation, and the provision of a foundry for the casting of spare parts both of brass and iron. The company employs 800 Chinese laborers, and has a European staff of only eight. In addition to spending £110,000 on new plant a cash reserve of £60,000 has been built up, and dividends amounting to £30,000 have been paid.

* * *

The second best speech of the Congress was that of R. H. Webb, mayor of Winnipeg. He has the knack of saying things in an arresting way, and, moreover, he appears to have ideas. He talked at luncheon for an hour, and most people thought he had used fifteen minutes. He said he would not be British if he didn't want to get something for Manitoba in exchange for the hospitality extended to the visitors. He felt, he said, like the Englishman who takes a guest to his home, wines him and dines him, and then sells him a bill of goods. He then set out to sell Manitoba to the Congress.

* * *

In the excitement incident to the first evening in Banff, I neglected to mention, in writing about Porcupine, an important tendency in mining methods. Shrinkage stoping until recently had been depended upon almost exclusively for extracting the ore. Now, in the McIntyre mine a cut-and-fill system is being used extensively and in some places where the ground is heavy and the orebody wide, square-setting is the method. At the Hollinger some 3,000 tons of sand and gravel is being transported by aërial tram from a deposit 5 miles away for filling old stopes. This is in addition to the current supply of waste from development operations. To just what extent cut-and-fill methods are being adopted at the Hollinger is not easy to discover. It seems apparent, however, that the advantages—or perhaps one should say the necessity—of filling are being recognized. Cleaner mining is assured; and, where there is a multiplicity of parallel veins comparatively close together, filling seems necessary unless large blocks of ground are to be "lost."

* * *

E. C. Bloomfield for the past two years has been general manager for the Tetiuhe Mining Corporation, operating a lead-zinc-silver mine 200 miles northeast of Vladivostok. The deposit was discovered early in the present century and large quantities of zinc carbonate ore were mined from the upper levels. For the treatment of the sulphide ore, which averages 10 per cent lead, 13 per cent zinc, and 8 oz. silver, a concentrator was erected just before the war. Owing to the presence of a heavy pyroxine, however, a separation of the zinc sulphide was difficult. British interests took over the property in 1925 and introduced selective flotation with excellent results. High-grade concentrates of both zinc and lead are made for shipment to European smelters. This is the first mining concession granted to British interests by the Soviet since the revolution.

* * *

H. R. Stafford, mine engineer for Burma Corporation, Ltd., with headquarters at Bawdwin, Upper Burma, says that in April of this year his company mined 42,000 tons of ore, which was a record for the company. Of this tonnage 6,000 was direct-smelting ore, averaging more than 35 per cent lead. The fire area is being reopened rapidly and the mine is in good condition. Development on the eighth level, the scene of the newest work, is showing the Chinaman lode to be as extensive as ever. The ore is a little leaner in silver and zinc but a little richer in lead, the average value being about the same as on the levels above.

* * *

To reach the Allenby mine of the Granby company it is necessary, after leaving the terminal of the branch railway from Princeton, to make a rather blood-curdling ascent in an open skip about 1,500 ft. up the side of a mountain that seems in places to "lean backward," it is so steep. Several of the ladies expressed very earnestly their decision to stay below; changing their minds only when it was pointed out that the alternative was to go hungry until the next morning. Even after the visit was safely over, some of them felt a little unkindly toward H. C. Smith, the general superintendent at the mine, for not having warned them so that they could have remained at Princeton. By this time they are probably glad that they got the thrill.

G. H. Tipper, superintendent of the Geological Survey of India, says that the recent acquisition of a controlling interest in several of the largest manganese mines in the Central Provinces, by the Norman Long steel interests in Great Britain, will assure regular production in India for many years. It is not always recognized that India, with a contribution of 600,000 tons of 50 per cent ore annually, is an important factor in the world's manganese production.

* * *

A. G. Burrows, geologist for the Province of Ontario, was the victim of one of the few untoward episodes on the tour. While looking at a "Shuveloder" in the Sullivan mine he was drenched by a small cold geyser that developed under him when someone stepped on a temporary high-pressure water line and broke a union. The ministrations of Mrs. Burrows doubtless saved him from contracting pneumonia.

* * *

Dr. C. F. Elam is the only lady in the party that has distinguished herself for scientific achievement. She has a doctorate from London University and is now engaged in research at the Royal School of Mines. She leaves the Congress at Banff to go to Detroit, to attend the meetings of the Institute of Metals division of the A.I.M.E., the American Society for Steel Treating, and the Society of Automotive Engineers. She will confer on matters connected with her work with scientists in Pittsburgh and New York before returning to London.

* * *

When Miss Elam first wrote to the headquarters at Montreal to make her reservations for the Congress, she said that it would be agreeable to her to share a stateroom on Tour "A" with some young lady who was not otherwise provided for. That this letter caused some consternation among the secretaries, who had not heard of Miss Elam, can be imagined, for the signature was briefly "Dr. C. F. Elam."

* * *

One of the assistant train secretaries, rounding up baggage in the Toronto station at midnight, solicitously approached a dignified overseas traveler with the query: "Colonel, did I understand that you had lost something?" "Something!" replied the Colonel, "I've jolly well lost everything."

* * *

Only one of the five "Sirs" who started at Montreal stayed the tour out. Sir Robert Horne and Sir Thomas Holland got no further than Ottawa; Sir Richard Redmayne fell by the wayside at Winnipeg; Sir William Furse was so entranced by the scenery at Banff that he stayed there. This left Sir Albert E. Kitson as the only representative of the titled aristocracy to arrive with the other members of the Congress at the city of Vancouver.

How Selective Flotation Is Affecting Metallurgical Practice

Siliceous Oxidized Lead Ores More Economically Treated—Changes Slowly Taking Place in Pyrometallurgy of Copper

By L. O. Howard
Mining Engineer, Pullman, Wash.

I HAVE been interested for some time in watching the effect of selective flotation on metallurgical practice. At the recent symposium on flotation at Salt Lake City there was brought out at various times additional information that it seems to me it is worth while to assemble in a brief article. For instance, it was estimated by Ernest Gayford,[1] of the General Engineering Co., that 76,000 tons was annually carried in the slag of the three Salt Lake Valley smelters, for which $750,000 worth of flux was needed. A. B. Young,[2] of the International Smelting Co., gave estimates of (prewar) 50,000 tons and (now) 25,000 tons of zinc carried out in slag, and gave as the cost of eliminating zinc in the blast furnace 30 to 40 cents per unit, or a saving of $800,000 to $900,000 annually in lead blast furnace smelting costs through the reduction of zinc in blast furnace charges, due to its removal from the ore as zinc concentrate by selective flotation. When matte is made zinc remains as a troublesome mush. It takes iron to eliminate it. Using more iron makes a slag of high specific gravity—makes more slag and higher metal loss. By eliminating gangue and much pyrite from the lead concentrates the functions of the blast furnace have been considerably simplified. Previously, siliceous ores have been in excess in the district, or, we might say, "insoluble" ores. The first big effect of flotation cited by Mr. Young has been due to the practice of making a 60 per cent lead concentrate, then a high zinc concentrate and finally a pyrite concentrate. This has obviated the smelting or mining of nearly barren iron ores for fluxing purposes. The pyrite has sufficient value to make it a desirable flux. Through the better removal of gangue in the lead concentrate this part of the charge has been lowered in insoluble. These two conditions working together mean that siliceous oxidized lead ores can now be more economically treated, and the insoluble penalties cut. The iron of the pyrite can be used for flux, or can be stockpiled for later use in fluxing some highly siliceous ore, thus allowing more flexibility in smelting.

W. H. Eardley,[3] of the United States Smelting, Refining & Mining Co., brought out the fact that before flotation came in, the Midvale smelter received 4,000 tons monthly of lead concentrates containing 25 per cent lead and 10 to 11 per cent zinc, and 1,000 tons of pyrite concentrates containing 5 per cent lead and 10 to 11 per cent zinc. Forty-five per cent of this material was coarser than 45 mesh. Now the smelter gets 4,300 tons of flotation lead concentrates containing 60 per cent lead and 4 to 5 per cent zinc and 4,000 tons of pyrite containing 2 per cent lead and 10 per cent zinc. The moisture content is about 8 per cent, but 85 per cent of it is through 200 mesh. In the district the smelters have had to treat from 10 to 30 per cent less tonnage in the blast furnace. There is not enough sulphur in the flotation concentrates alone for good roasting in the McDougall-type furnace. Flotation concentrates for sintering are mixed with other ingredients. Opinions differ as to the best mix. Practices in common use include:

1. Mixing in 10 per cent of granulated slag and passing once over the Dwight-Lloyd machine. The sulphur in the sinter is often high and oxidation is not as complete as in double sintering.

2. Drying the concentrate in McDougall-type furnaces, and then sending to the Dwight-Lloyd plant for mixing. This costs more than to roast first. There is, however, less dust loss. Sulphur is still high (3.5 per cent) and oxidation is not complete.

3. Mixing wet with other ingredients and passing once over the Dwight-Lloyds. If 45 per cent of the material is siliceous and sulphur is below 9.5 per cent, the sulphur in the sinter may be as low as 2 per cent. The structure is good and the volatilization losses are less than in double sintering.

4. Increasing speed of grate travel and using a thicker bed. None of the material should be coarser than ½ to ¾ in. The sinter is crushed and re-run, perhaps with fresh material (partial double sinter). This method is favored in the Salt Lake Valley, giving 1.5 to 2.5 per cent sulphur in the sinter, better reduction, longer furnace campaigns, and less matte fall. At Midvale, it is not considered profitable to use granulated slag to avoid double sintering or to dry in McDougalls. If there is 45 per cent silica, single sintering is most profitable. Otherwise a partial or complete double sintering is used, with ¼ to ½ in. as the desirable maximum size

[1]Definition, Present Status and Future of Flotation. Unpublished paper presented at regional meeting, A.I.M.E., August, 1927, Salt Lake City.
[2]Flotation and Lead Smelting (Zinc and Fluxes). Unpublished paper.
[3]Flotation and Lead Smelting (Roasting and Sintering). Unpublished paper.

of particles in the charge. Of course, a proper mixture and 8 to 9 per cent moisture is needed.

Richard A. Wagstaff,[4] of the American Smelting & Refining Co., pointed out that in blast-furnace treatment of flotation lead concentrate there had been no change in the percentage of coke used or in tonnage per furnace, but higher blast pressures were being used and less slag of higher lead content was being made. The total tonnage treated in the Salt Lake Valley was 75,000 to 90,000 tons five years ago and had dropped to 40,000 to 50,000 tons now.

Effect on Copper Smelter Practice

B. L. Sackett, of the International Smelting Co., mentioned some of the effects of selective flotation at the copper smelter as decreased tonnage to be handled, fewer furnaces operated, increased copper on the charge, and increased difficulty in handling the material. In a process based on the roasting of concentrate the handling of calcine is more difficult and dust losses are increased. When straight flotation was used it was necessary to purchase siliceous materials to flux the iron of the pyrite, but this is no longer necessary.

A reading of A. T. Tye's paper[5] shows that at Cananea the reverberatory furnace is hardly more than a melting furnace raising the grade less than 3 per cent in passing through the furnace (without previous roasting) a 17.47 per cent copper concentrate for a 20.30 per cent matte.

Handling problems were increasing at Bisbee and Nacozari, according to W. B. Cramer, of the Phelps Dodge company. The ratio of concentration at Bisbee is now 11 or 12 to one, where previously it was 3.75 to one, and 90 per cent of the material at the smelter is through 200 mesh, and 75 per cent through 300 mesh. The copper concentrate contains 17-18 per cent copper, owing to the elimination of 75 per cent of the pyrite by selective flotation. At Nacozari 95 per cent of the pyrite is dropped. Special changes in smelter operation or practice were not brought out.

F. J. Longworth, of the Tennessee Copper Co., stated that for four years his company had been smelting all its concentrates direct in a Peirce-Smith converter, using the Garr run to feed it, and that the ratio of concentrate to matte was now one to one, some eighty tons of each being smelted daily. The concentrates are not dried or roasted and contain 8 to 12 per cent moisture and about 12 per cent copper. The dust loss is very small, less than it would be in roasting this same concentrate. There is no boiling and no explosion when using the Garr gun. The insoluble in the concentrate is 5 to 6 per cent and additional siliceous flux is introduced just as in ordinary matte blowing. The recovery, concentrate to blister, is over 96 per cent. Further details of early work are given in an earlier paper by Mr. Longworth.[6]

In discussing Mr. Tye's paper I brought out that by selective flotation the Tennessee Copper Co. made separate concentrates of copper and iron and roasted and sintered the iron concentrate to a product containing 64 per cent iron and less than 0.1 per cent sulphur, which was sold as ore for iron blast furnaces. Acid is made from the sulphur gases.

Slowly but surely changes are coming in the pyrometallurgy of copper. With the grade of concentrate increasing, tonnage to be smelted is decreasing (one-third in some plants) and the number of furnaces in use is being cut down. In some cases, as at Cananea, the roasters have been eliminated, and at others their work is greatly reduced. In still other cases selective flotation has eliminated both roasters and reverberatories, as at Ducktown. Slag production is greatly reduced everywhere and, in general, slag losses are diminished. Handling problems are being met. The amount of equipment and labor per pound of copper is being greatly reduced, and higher recoveries of copper are made.

Where mines and smelters are part of the same operation, one can look for large economies in smelting copper, owing to less tons to be smelted per ton of copper produced, less slag, lower metal losses in slag, higher smelter recoveries, lower labor requirements, fewer furnaces needed, and less flux to be bought. Where a smelter depends upon custom business and therefore upon tonnage for profits, the case may be quite different and certain plants are undoubtedly causing their managers to ask "What next?"

[4]Flotation and Lead Smelting (Blast Furnaces). Unpublished paper.

[5]Effect of Preferential Flotation at Cananea Mill and Smelter. A.I.M.E. Technical Publication No. 3. August, 1927.

[6]F. J. Longworth: Smelting Copper Concentrates in a Converter. Trans. A.I.M.E., 1925.

San Francisco Section Told Story of Chuquicamata

The San Francisco section of the American Institute of Mining and Metallurgical Engineers, at its monthly meeting, Sept. 13, at the Engineers' Club, San Francisco, passed two resolutions, one being a protest against the cut in the appropriations of the Bureau of Mines and the other a protest against further agitation for the removal of the museum and the offices of the California State Mining Bureau from San Francisco to Sacramento. In addition, the section unanimously nominated F. W. Bradley as the recipient of the W. L. Saunders medal for achievements in mining, and also nominated E. L. Oliver as the recipient of the James Douglas medal for achievements in non-ferrous metallurgy.

Fred Hellman, who is spending a vacation in California, was the speaker of the evening, and informally told the members the story of Chuquicamata. He said that the Chuquicamata deposit contains an estimated total of 15,000,000 tons of copper and is the largest known deposit of its kind. Katanga contains an estimated total of 10,000,000 tons, but the estimates have been less thoroughly made than those of Chuquicamata. He called attention to the fact that 70,000 tons of machinery and equipment had been hauled to Chuquicamata over a 30-in. gage railroad and remarked that the advantages of narrow-gage railroads have been overlooked. The betterment of the Chilean labor and living conditions accomplished by the Americans was described. Mr. Hellman said that the most striking feature of the Chuquicamata deposit was its color, which gives ocular proof of its extent. Mining methods and the metallurgy of the ores were briefly sketched. A general discussion closed the evening.

Ceramists to Tour Europe in 1928

The American Ceramic Society has announced that it is sponsoring a ceramic tour abroad for the period of May 19 to July 5, 1928. Membership in the tour is open to all those interested in ceramics. The tentative itinerary includes visits to many European ceramic centers, such as Stoke-on-Trent, England; Delft, Holland; Meissen, Germany; Prague, Czechoslovakia; and Paris, France.

Applications for membership in the tour should be addressed to the American Ceramic Society, 2525 North High St., Columbus, Ohio, or to Executive Tours, 25 Broadway, New York City.

August Meetings of South African Societies

At the monthly meeting of the South African Institution of Engineers, held in Johannesburg on Aug. 11, Dr. J. H. Dobson presented a paper entitled "A Survey of the Engineering Aspect of Improving Temperature and Humidity Conditions of Mine Atmosphere at Great Depths."

Dr. E. Kaiser, professor of geology at Munich University, lectured in Johannesburg on Aug. 17, under the auspices of the Geological Society of South Africa, on "Surface Geology in Arid Climates."

At the meeting on Aug. 20, of the Chemical, Metallurgical and Mining Society of South Africa, the new president, Sir Robert N. Kotzé, delivered his address on "South African Legislation in Regard to Safety and Health in Mining."

The Pretoria Chamber of Commerce has been advised by the Geological Society of South Africa that it has now been definitely decided that the fifteenth international geological congress will be held in South Africa. The headquarters of this congress will probably be in Pretoria.

Personal Notes

CHARLES S. HALEY, mining engineer of San Francisco, was in New York last week.

R. B. LAMB has changed his address from the C. P. R. Building, Toronto, to Room 307 Reford Building, Bay St., in the same city.

J. V. N. DORR arrived in New York today from Naples on the "S.S. Roma." He has been traveling in Europe for the last three months.

H. M. TABERER, native labor adviser to the Transvaal Chamber of Mines, who attended a conference at Geneva recently, has returned to the Rand.

EDWIN F. GRAY, president of the Vivian Tunnel Co. and other corporations operating at Contact, Nev., was in Salt Lake City on business recently.

C. N. HUTCHONS, late mine captain on the Rose Deep gold mine, after eighteen years' service has acquired a farm at Mulder's Drift on the West Rand.

WALTER A. SCHMIDT, president and general manager of the Western Precipitation Co., has left Los Angeles for New York on a trip of several weeks' duration.

J. WATTS BAGLEY, of New York, has been examining mining properties in the Goudreau area of northern Ontario on behalf of important Wall Street interests.

GEORGE A. PACKARD, consulting mining engineer of Boston, made an examination of several properties in the Elk City district in September for his Eastern clients.

PAUL SELBY, manager of the Ferreira Deep gold mine, recently made a three weeks' trip to the Sabie game reserve, in the Eastern Transvaal, to photograph big game.

EARL F. ELSTONE, a graduate of the Idaho School of Mines in the class of 1927, has joined the staff of the Moctezuma Copper Co. at Pilares de Nacozari, Sonora, Mexico.

Dr. W. S. MCCANN, after having combined professional work with attendance at the Empire Mining and Metallurgical Congress in Canada, has returned to London.

R. C. GAMBLE, a director of the Stadacona Mines, Ltd., is on his way to the Red Lake area of northern Ontario to open up the property of the company adjacent to the Howey.

DR. WILBUR NELSON, state geologist of Virginia, was in San Francisco recently on his way to the meeting of the Empire Mining and Metallurgical Congress at Vancouver.

W. WYBURGH, of the Geological Survey, Cape Town, has returned to Pretoria from his field investigation work around Komatipoort. He will remain in the Transvaal for some weeks.

SAM SOUPCOFF, field engineer for the American Smelting & Refining Co., has returned to Salt Lake City after an absence of several weeks visiting southern Nevada mining districts.

FREDERICK PASSOW, lately with the Eustis Copper Corporation, of Eustis, Que., has been appointed manager for the Windfall Rouyn Mines, in the Rouyn area of Quebec.

BERT ASHLEY, who has had a wide experience in the mining industry of northern Ontario, has been appointed engineer in charge of the Telluride, in the Kirkland Lake area.

H. D. BUDELMAN, mine superintendent for the West End Consolidated Mining Co. and affiliated companies at Tonopah, Nev., has returned to Tonopah from a trip into southern California.

G. C. CONLEY, of Spokane, Wash., recently visited Kimberley, South Africa. In commenting on local conditions Mr. Conley said, "You need another Cecil Rhodes to settle your diamond question."

R. R. BROWN has been appointed managing director and T. R. BUCHANAN, mine manager of the Federal Kirkland Mines, Ltd., recently organized, to operate in the Kirkland area of northern Ontario.

WALTER J. PENTLAND, who has been manager of the Amatlan Mining Co., Chalchihuites, Zacatecas, Mexico, since September, 1926, has retired, his present address being Room 202 Ideal Building, Denver, Colo.

HARMAN B. MILTON, who has been associated with several leading mining companies, has been appointed consultant engineer by the Frontenac Copper Mines, Ltd., and is arranging an extensive development program.

HUGH PARK, manager of the Nipissing mines, is visiting the Montbray property of the company, in the Rouyn area of Quebec, where development has reached an important stage in the opening of the orebody at the 225 level.

G. H. DOWELL, formerly general manager of the Copper Queen Branch of the Phelps Dodge Corporation, and who was compelled to resign this position owing to ill health, has taken up his residence at Long Beach, California.

DOUGLAS WRIGHT, who has been prominent in exploration work in the Patricia gold fields of northern Ontario, has been appointed consulting engineer to the recently organized Jackson-Manion Mines, Ltd., operating in the Woman Lake area.

FREDERICK BURBIDGE, of Wallace, Idaho, general manager of the Federal Mining & Smelting Co., is in Baxter Springs, Kan., headquarters of the company's large operations in the Tri-state field. He will probably go to New York before returning to Wallace.

J. J. BEESON, Salt Lake consulting geologist, has sailed from New York for Puerto Colombia to make an examination of a tin property near Bogota. From Puerto Colombia, Mr. Beeson will go by airplane into the interior, making a journey in a few hours that would ordinarily take days.

Dr. J. M. SMITH, of the Johannesburg Medical Board of Appeal, recently returned to South Africa from Canada, where he has been advising the mining authorities as to the best methods of combating miners' phthisis in Ontario. The doctor also visited Washington to confer with the head of the Industrial Diseases Department of the United States.

W. A. LEDDELL recently opened an office in El Paso, Tex., for the design of metallurgical plants. He is designing a 500-ton copper concentrator for one of the English companies operating in Mexico. In the last two years Mr. Leddell has been responsible for the Noria unit of the El Oro Mining & Railway Co., at Sombrerete, and for the increase in plant capacity at the Cia. San Rafael y Anexas, at Pachuca.

OBITUARY

T. J. CUNDILL, town clerk of Windsorton, Cape Colony, South Africa, is dead. He went to the diamond fields in the early eighties and was a digger for many years.

GEORGE H. THURSTON died recently in London at the age of fifty-eight. Born in Australia, he went to the Transvaal in 1893, for Fraser & Chalmers. He was resident engineer for several years on the City & Suburban mine; also on the Simmer & Jack.

HUGH FARNCOMBE, a mining engineer and a graduate of the Toronto University, formerly of Trenton, Ont., who had been practising his profession for some years in Chile, South America, was recently killed in a mine accident. The cause was stated to be an explosion or a cave in.

ARTHUR E. CLIFFORD, for many years connected with the McGraw Publishing Company and its successor, the McGraw-Hill Publishing Company, Inc., as business manager of the *American Electrician* and the *Electrical World*, died on Sept. 20. Mr. Clifford was born in New Hampshire. He was about fifty-nine years old.

ERNEST L. HARTWELL died recently in Denver, Colo. He had been for the last ten years manager of the Yak mines, at Leadville. Mr. Hartwell was born at Clay Center, Kan., on Nov. 1, 1883, and followed mining throughout the Western states. He received his engineering degree from the Ohio Northern University. He spent several years in Nicaragua, following placer mining, after which he came to Leadville, first as superintendent of the Yak mines. Later he was appointed general manager. Flotation milling was Mr. Hartwell's principal interest of late years. At the time of his death he was general manager of the Colorado Zinc-Lead flotation mill.

MARKET AND FINANCIAL NEWS

A London View of The Silver Outlook

The recent break in the price of silver was the consequence, not of the selling of the nine million ounces of fine silver by the Indian Government, but of the announcement that the sale had been completed, says *The Statist* (London). This led to a good deal of bear selling, owing to the general belief that the Indian government intended to force the realization of its undoubtedly large stock of low-grade silver on the market. It is argued, however, that this notion is incorrect, as the demand for low-grade metal is limited and is chiefly from India, and it would certainly not stimulate local consumption if the price of the metal were forced down by the dumping on the market of supplies in excess of requirements. Nor must the political position be ignored, continues the journal quoted. The mass of the population of the country invest their savings in silver, and if the value of such savings were depreciated by the action of the Indian government it is probable that much unrest would be created. India has been absorbing silver, and, as the country is reported to be prosperous, that demand should continue, and there is no reason why the stock held by the government should not be absorbed within the ten years contemplated by the Currency Commission.

Authorities, therefore, do not consider that the contemplated policy of the Indian government is likely to have any direct bearing on price fluctuations in the metal. The main influences are likely to be found elsewhere. The position in China is one of the determining factors, and, given a period of tranquillity there, the price should advance.

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World Zinc Production Shows Little Change

The production of slab zinc for the month of July amounted to 116,260 tons, compared with 116,533 tons for June. The detailed figures for the two months are as follows:

Production of Slab Zinc

	1927	
	June	July
United States	49,718	47,627
Canada	5,511	6,074
Mexico	513	595
Belgium	18,186	18,249
France	7,524	7,624
Germany	7,692	7,880
Great Britain	4,984	5,152
Netherlands	2,398	2,400
Poland	1,937	1,845
Polish Silesia	11,956	12,468
Spain	1,544	1,624
Australia	4,570	4,722
Totals	116,533	116,260

Yukon Ores Royalty Exemption Is Extended

Upon the recommendation of the Minister of the Interior, the exemption from payment of royalty on the content of silver-lead ores shipped from the Yukon Territory has been extended to Jan. 1, 1928. It is explained that the reason for this action is that no smelter capable of treating such ores has yet been established in the territory, and it is still necessary to transport all the ores mined there to the Pacific Coast smelter for treatment, entailing very high transportation costs. According to report, the quantity of ore in sight, capable of defraying such costs, is approaching exhaustion, so that it will be necessary to ship ores of less value if the industry is to be satisfactorily maintained.

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United States and Mexican Lead Production Decreases

According to figures recently issued by the U. S. Bureau of Metal Statistics the United States and Mexican lead production decreased slightly during August. The table appended gives the statistics recently issued by the American Bureau of Metal Statistics. It will be noticed that receipts by United States smelters of lead in ore are declining and that although United States imports in July were above the average there was a decrease compared with the month of June.

Great Britain Imports Less Zinc

Great Britain, the leading zinc importing nation of the world, reports for the first seven months of the current year average imports of 11,086 metric tons of metal per month, a decline compared with the average of 11,840 metric tons a month imported in the twelve months of 1926, according to the American Bureau of Metal Statistics. Germany has been the second largest importer of this metal, taking an average of 8,808 metric tons a month over the first half of the year, compared with 6,288 metric tons a month during 1926.

French imports in the first half amounted to an average of 1,864 metric tons a month, as compared with 3,522 metric tons monthly in 1926. Czechoslovakia and Japan each shows imports averaging more than 1,200 metric tons a month during the first four to six months of 1927, which was about up to the average of 1926 for the former but a considerable decline compared with last year's Japanese imports.

Exports from the United States in the first seven months of the current year were 27,323 net tons of zinc in slabs, blocks, pigs, and other forms, which compares with a total of 21,376 tons in the corresponding period last year.

The supply of zinc ores to European smelters for the month of May reached a total of 115,928 tons, according to figures recently published. Mexico, Italy, Silesia and Australia were the chief sources of this supply.

Summary of Lead Statistics—1927

(In Tons of 2,000 Pounds)

	Feb.	March	April	May	June	July	Aug.
Production—United States and Mexico							
Crude	74,768	84,339	82,410	79,146	79,742	81,999	79,701
Refined	70,003	78,609	76,048	72,054	75,253	76,518	78,378
Antimonial	1,875	2,588	1,354	1,471	1,246	1,287	1,493
Production—Foreign							
Canada	10,761	12,511	12,118	12,917	12,037	12,445	(b)
Mexico	20,599	23,188	22,217	21,840	21,318	24,444	22,918
Germany	6,953	7,732	6,969	8,165	8,000	7,831	(b)
Italy	2,401	2,589	171	1,918	1,989	2,779	(b)
Polish Silesia	2,028	2,191	1,360	2,673	1,691	1,800	(b)
Spain and Tunis (partial)	11,515	13,891	12,471	10,186	12,107	10,255	(b)
Australia	13,308	14,775	15,689	14,768	14,629	17,410	16,110
Burma	5,320	5,840	6,064	6,189	6,125	6,160	(b)
Rhodesia	538	566	560	560	560	560	(b)
Receipts of Lead in Ore							
By United States smelters	54,402	62,334	63,322	59,771	56,432	51,938	(b)
By Mexican smelters	18,270	23,083	21,550	18,446	19,470	18,728	(b)
Totals	72,672	85,417	84,872	78,217	75,902	70,666	(b)
Stock—End of Period							
United States and Mexico (members only)							
In ore and matte (c)	46,922	49,839	55,885	55,909	53,370	44,388	(b)
In base bullion (d)	52,649	53,880	60,272	65,952	68,551	72,259	(b)
Refined (including antimonial)	40,253	41,047	44,280	53,369	48,366	48,942	43,189
Total stocks	139,824	145,766	160,437	175,230	170,287	165,589	(b)
Great Britain (e)	2,908	3,060	3,268	2,763	2,728	2,728	2,342
Imports—United States	12,307	14,443	13,353	7,217	17,737	16,067	(b)
Exports—South America (a)	6,952	6,975	10,179	8,320	12,347	13,488	(b)

(a) Exports of foreign pig lead are included, except for latest month reported. (b) Not yet reported. (c) Includes lead in process at smelteries. (d) Includes lead in process at refineries. (e) Official warehouses only.

South America Increases Copper Production

The table of world copper production which appears herewith indicates that there is little tendency toward further limitation of output; in fact, the August production was slightly higher than that of either of the preceding two months. Chile and Peru seem to be increasing their output, and the same tendency will be noted in the production of the Belgian Congo. As the Union Minière proceeds with its program of furnace construction the Congo figure must be expected gradually to increase. Canada and Mexico seem to be decreasing output slightly, but United States production, which is the main factor in world statistics, increased 3,000 tons as compared with July.

The table of production is taken from the latest circular of the American Bureau of Metal Statistics.

Copper Production of the Principal Producing Countries

(Tons of 2,000 Pounds)

	April 1927	May 1927	June 1927	July 1927	Aug. 1927	Jan.-Aug. 1927
United States	80,940	82,132	77,847	75,029	78,030	644,727
Mexico	3,460	4,223	4,029	3,702	3,403	29,935
Canada	3,482	3,046	2,652	2,761	2,340	23,414
Chile and Peru	23,820	23,840	23,032	24,738	25,120	192,558
Japan	6,061	6,168	6,111	5,771	(b) 6,000	46,612
Australia	410	840	2,054	103	517	5,673
Europe (a)	11,500	11,800	11,500	12,000	11,800	90,110
Belgian Congo	6,056	7,065	7,018	8,082	8,025	56,042
Totals	135,729	139,114	134,243	132,186	135,235	1,089,061
Estimated for non-reporting countries	3,000	3,000	3,000	3,000	3,000	24,000
World's total	138,700	142,100	137,200	135,200	138,200	1,113,100

(a) Incomplete; partly estimated. (b) Estimated.

Canada Increases Production of Lead in 1926

Finally revised statistics on the production of lead in Canada in 1926 as reported by the Mining, Metallurgical and Chemical Branch of the Dominion Bureau of Statistics show that a new record in quantity produced was established when the total recovery amounted to 283,801,265 lb. valued at $19,240,661 as against 253,590,578 lb. valued at $23,127,460 in 1925.

Production for the first six months of the current year was at the rate of 291,150,000 lb. per year.

Madagascar Resumes Graphite Shipments

It will be remembered that a cyclone and tidal wave did so much damage to the port of Tamatave early in March of this year that no graphite shipments were possible until the completion of the rebuilding of the railway bridge. This has now been accomplished, and a considerable quantity of graphite was shipped during June. The figures issued by the Madagascar customs show the following exports during the first half of the present year:

Exports to	Metric Tons
England	2,042
France	1,404
Germany	383
United States	171
Other countries	76
Total	4,076

Upper Silesian Zinc Output Increases

As a result of the operation of the Blei-Scharleygrube of the Giesche Gesellschaft, Anaconda's subsidiary, German Upper Silesian production of zinc ore has increased since last year to approximately 14,000 metric tons monthly and lead to something more than 1,300 tons. The Blei-Scharley operation is mining not only zinc blende, but also some carbonate. The outlook for increased German Upper Silesian production becomes more encouraging, reserves in that quarter being estimated at some 10,000,000 tons.

The Giesche Gesellschaft still plans to erect a zinc smelter on its German property, but when this will be done is not known. It will be recalled that with the partition of Upper Silesia in 1922 in favor of Poland, Germany lost all of its dozen or so zinc smelters with their coproduct sulphuric acid. Two zinc oxide plants in course of construction in German Upper Silesia are processing low-grade ores.

Lake Shore Mines Declares Dividend

The directors of the Lake Shore Mines have declared the regular dividend of 10 per cent payable Sept. 15 to shareholders of record Sept. 1, together with an extra bonus of 10 per cent, making a total of 60 per cent for the year. The production for the first six months of the present year amounted to $1,570,438 from 117,633 tons, an average of $13.35 a ton as compared with $16.03 for the corresponding period of 1926 and $19.13 for corresponding period of 1925. The total production for the first half of the present year was $350,000 in excess of the corresponding period of the previous year.

August Tin Statistics Show Only Small Decrease in Visible Supplies

According to advices from London, the world output of tin continues to increase, whereas consumption, if not actually decreasing, shows no improvement. Total visible supplies on Aug. 31 amounted to 14,444 long tons, compared with visible supplies on July 31 of 15,085.

Answer to Silver Suit Will Be Filed Next Week

It had been expected that the government's answer to the suit of the American Silver Producers' Association to compel the purchase by the Treasury Department of 15,000,000 oz. of silver at $1 per oz. to complete purchases under the Pittman Act would be filed this week in the District of Columbia Supreme Court. According to a bulletin of the American Mining Congress, Special Information Service, however, it was stated at the office of the District Attorney that the answer would not be filed until next week.

Mexican Corporation's Fresnillo unit during the quarter ended June 30 made a gross operating profit of $101,033. Of this sum, $59,331 represents the share of the Mexican Corporation before deducting reserve for depletion and depreciation and $10,329 Mexico City office expenses. According to the report issued to shareholders, the mill treated during the period 229,761 tons of oxide ore and 30,890 tons of sulphide ore. Development work on the Cueva Santa vein gave satisfactory results. Work on the 165-meter level was suspended, but on the 215-meter level drifting west opened up a total of 338 ft., the last 217 ft. of which was in pay ore averaging 23.4 oz. silver per ton, 17 per cent lead, 9 per cent zinc, and 1.5 per cent copper for a width of 5 ft. On the 270-meter level the west drift was advanced 333 ft. all in ore averaging 0.05 oz. gold, 20.9 oz. silver per ton, 18.5 per cent lead, 12 per cent zinc, and 1.1 per cent copper for a width of 5 ft., making the total length on the oreshoot on this level 1,185 ft., averaging 0.05 oz. gold, 16 oz. silver, 15.1 per cent lead, 14.6 per cent zinc, and 0.7 per cent copper. The report states: "Results of work done on the Cueva Santa oreshoot have already exceeded expectations and now leave no doubt that an orebody of prime importance is in the course of development."

San Francisco Mines of Mexico reports an estimated operating profit for August of $155,758. The following is a summary of the month' operations:

Ore treated, tons	22,590
Residues treated, tons	830
Lead concentrates produced, tons	3,030
Zinc concentrates produced, tons	3,650
Estimated net smelter returns:	
On lead concentrates	$177,787
On zinc concentrates	102,907
Total	$280,694
Operating expenses	$124,936
Estimated operating profit	$155,758

Broken Hill Proprietary Co. reports a profit for the year 1926 of £291,576 after providing £318,978 for depreciation. During the year 1926, 178,887 tons of ore was hoisted, the best tonnage since 1917. The following are further details of operations:

	Long Tons
Ore smelted	164,292
Dump tailings smelted	22,393
Coarse jig concentrates produced	12,347
Flotation plant: Ore treated	174,338
Lead concentrates produced	19,672
Zinc concentrates	24,637

The Market Report

Metal Markets Have Dull Week—Price Concessions Made

New York, Sept. 28, 1927.—Producers of the non-ferrous metals can find little ground for optimism in the market report for the week ending today. Sales of all metals have been meager, and the prices for all the more important ones are lower today than a week ago. Though most of the economic reports indicate a satisfactory rate of industrial activity for the fall months, the metal-manufacturing industries apparently are receiving a disappointing volume of orders, judged by this week's bookings for crude metal. Under present conditions, they are unwilling to speculate, and low prices will not tempt them unless they see where they can use the metal.

Daily Prices of Metals

Sept.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	12.95@13.025	59.50	60.50	6.25	6.05	6.175
23	12.95	58.75	59.625	6.25	6.025@6.05	6.175
24	12.95	58.25	59.25	6.25	6.025@6.05	6.15
26	12.95	58.375	59.50	6.25	6.00	6.15
27	12.80	57.75	58.75	6.25	6.00	6.15
28	12.775	57.375	58.625	6.25	6.00	6.075@6.10
	12.902	58.333	59.375	6.250	6.021	6.148

Average prices for calendar week ending Sept. 24, 1927, are: Copper, 12.985; 99 per cent tin, 59.833; Straits, 60.542; N. Y. lead, 6.250; St. Louis lead, 6.056; zinc, 6.198; and silver, 55.875.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there the other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
22	54 7/16	54 7/8	61 3/4	273 1/2	271	21 3/8	21 13/16	27 5/16	27 5/16
23	54 3/8	54 9/16	61 1/2	270 7/8	269	21 1/8	21 9/16	27 1/8	27 1/8
26	54 1/4	54 5/8	61 3/4	268	265 3/4	21	21 1/2	27 1/8	27 1/8
27	53 7/8	54 3/16	61 1/2	266	264	20 13/16	21 3/8	27 3/8	27 3/16
28	54	54 5/16	61 1/2	263	261 1/4	20 1/2	21	27 7/16	27 3/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
22	4.86	55 5/8	25 5/8	84s11 1/2d	26	4.86 1/8	55 5/8	25 11/16	84s10 3/4d
23	4.86 1/8	56	25 3/4	84s11 1/2d	27	4.86 1/8	55 5/8	25 5/8	84s11d
24	4.86 1/8	56	25 13/16	.....	28	4.86 1/8	55 5/8	25 5/8	84s10 3/4d
					Avg.		55.750		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Copper Hard to Sell at 13c.

The excellent buying of last week has been followed by a wave of lassitude, and the tonnage disposed of during the week ended Sept. 28 was one of the smallest of the year. The foreign demand also has been poor throughout the week. In spite of the dullness of the market, the majority of producers refused to regard the situation pessimistically. Although consumers display no interest, sellers feel that most fabricators are under-bought. The continued requests that deliveries be made at the earliest possible moment and that the shipping date of lots purchased for October delivery be advanced are proof that consumers are buying only in the most hand-to-mouth manner. Most sellers, therefore, feel confident that the present lack of interest is only a passing phase, have made no attempt to coax the market and have merely quoted 13.25c.—"take it or leave it." Certain sellers who pursue the policy of always disposing of their output irrespective of market conditions have made large concessions from this price, and in consequence have practically monopolized the market. To obtain a price of even 13c., however, they have been compelled to make a wide canvass of the consumers who, although they have made purchases at this figure, cannot be said to jump at it. This fact is a significant index of the extremely torpid state of the copper market.

New York Lead Market Firm

The most that can be said for the lead market is that the American Smelting & Refining Co. is holding firm at its contract price of 6.25c., in spite of a quiet domestic demand and continued reductions abroad which have brought the London spot price today to £20½, the lowest level reached since March, 1922. The Smelting company feels that continued reductions here would not stimulate trade, and there is no danger, at present, of foreign bullion lead coming into the country. The leading producer in the Middle West has gone back to 6c., St. Louis, which seems to be the deadline for the time being, so far as this seller is concerned. Paint manufacturers have been in the market, but the inquiry from most consuming lines is small, particularly from those in the mixed-metal business.

Zinc Neglected

Less zinc has been sold in the week ending today than in any other week since February. Today zinc sold as low as 6.075c., though forward deliveries were higher. The mid-month statistics show an upward turn in the stocks, and the general situation may be characterized as weak.

Tin Well Below 60c.

Tin has broken through the 60c. level, and today is down to about 58⅝c. for prompt Straits, forward being about half a cent less. Most of the business

has been a switching of position by dealers.

Silver Quiet and Weak

The silver market during the last week has been quiet with a downward tendency. India has shown very little interest, as local rates were slightly above Indian parities. China has both bought and sold, and the market closes quiet with an uncertain tendency.

Correction: The silver price for the calendar week ending Sept. 17, in last week's issue, should have been 55.458c. instead of 55.457c.

Mexican Dollars (old Mexican pesos): Sept. 22d, 42⅛c.; 23d and 24th, 42½c.; 26th, 27th, and 28th, 42⅛c.

Foreign Exchange

Closing cable quotations on Tuesday, Sept. 27, were as follows: Francs, 3.92⅜c.; lire, 5.455c.; and marks, 23.82c. Canadian dollars, 9/64 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, spot business, 10⅜c. Market weak. Cookson's "C" grade, spot, 17¾c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

BISMUTH—Per lb., New York, in ton lots, $1.85@$2.10. London, 8s.

IRIDIUM—Per oz., $106@$110 for 98 @99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal.

PALLADIUM—Per oz., $52@$54. Small lots bring up to $58. Market dead and prices nominal. Pure metal as a constituent of crude platinum, nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Dealers and refiners quote the trade for refined metal, per oz., cash, $64.50@$66.

QUICKSILVER—Per 76-lb. flask, range for week $119@$120, nominal. Market shows little life. San Francisco wires $121.67. London, £21¾@£22.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Sept. 3.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports, minimum 47 per cent Mn. 36@38c. Caucasian, washed, 53@55 per cent, 40c. Chemical grades unchanged from quotations in the Sept. 3 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.25@$10.35. Western scheelite, $10.50@$10.75. Market dull.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the Sept. 3 issue.

Zinc Blende Again Lowered—Lead Ore Unchanged

Joplin, Mo., Sept. 24, 1927

Blende	Per Ton
High	$44.50
Premium blende, basis 60 per cent zinc	$41.00@ 42.00
Prime Western, basis 60 per cent zinc	40.00
Fines and slimes, basis 60 per cent zinc	36.00@ 39.00
Average settling price, all zinc	41.76
Galena	
High	$84.40
Basis 80 per cent lead	80.00
Average settling price, all lead	83.64

Shipments for the week: Blende, 13,438; lead, 1,000 tons. Value, all ore the week 644,890.

Shipments nine months: Blende, 489,280; lead, 75,894 tons. Value, all ore nine months, $27,262,430.

With an output of 15,500 tons, as against the shipment above shown, more than 2,000 tons was added to reserve stocks, yet the total unsold ore will not exceed one week's demand. With the price lowered to $40 basis for Prime Western, several operators have declined to restart mines long idle, where leases do not require mining regardless of profit or loss in the sale of the ore.

No change in lead prices was made, despite the exceeding weakness of the metal market, and the lead movement is restricted mainly to smelter-owned mines.

Platteville, Wis., Sept. 24, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$43.75
Lead Ore	
Lead, basis 80 per cent lead	$80.00

Shipments for the week: Blende 1,267 tons; lead 40 tons. Shipments for the year: Blende, 49,324; lead, 1,290 tons. Shipments for the week to separating plants, 1,886 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Sept. 3 issue.

Mineral Products

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Market slack. London, Cornish white, per long ton, £18¼.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Sept. 3 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, 78@82 per cent, $90, f.o.b. furnace, for delivery during second half 1927. Spiegeleisen, 19@21 per cent, $33@$35 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 93@96c. f.o.b. works. Dull.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Sept. 3 issue.

Metal Products

ROLLED COPPER—Per lb., f.o.b. mill, sheets, 22c.; wire, 15¼c.

LEAD SHEETS — Full rolled 10c.; clipped 10¼c. per lb.

Nickel Silver, Yellow Metal, and Zinc Sheets unchanged from prices in Sept. 3 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Sept. 3 issue.

Steel Weak and Lower in Spots

Pittsburgh, Sept. 27, 1927

Steel mill operations reflect the decrease in buying since the spurt of late August, and are at the lowest rate in more than two years. The notable fact is that production is at a lower rate than in July and August, whereas a seasonal increase has always been seen unless steel demand was engaged in a protracted decline. Steel ingot production is at between 60 and 65 per cent of full capacity, ingot output being at 115,000 to 120,000 tons per working day.

Steel prices leave much to be desired as to stability. In bars, shapes, and plates the anomalous position of 1.80c. being done on single carloads and effort being made to hold 1.80c. also as minimum, has been succeeded by 1.75c. being quoted on large lots and 1.85c. on small lots, an expedient of doubtful promise since it requires an advance to be obtained on carloads. Sheet prices are said to be holding rather well, and better than a fortnight ago. Tin mill black sheets are openly shaded $2 a ton, to 3.00c. on 28 gage, and there are widespread reports of weakness in strips.

Pig Iron—The Valley pig-iron market has been practically dead in the past week, affording no opportunity for test whether suspicions are correct that $17.50 could be shaded on foundry iron. Bessemer remains at $18 and basic at $17.

Connellsville Coke—There is scarcely any furnace coke contracting to be done for fourth quarter. The spot market is dull and easy at $3@$3.25 for furnace and $4@$4.75 for foundry coke.

Mining Stocks—Week Ended Sept. 24, 1927

Stock	Exch.	High	Low	Last		Last	Div.
COPPER							
Anaconda	New York	49⅞	47½	48⅝	Jy.16, Au.22	Q	0.75
Arcadian Consol.	Boston	*80	*75	*80			
Ariz. Com'l	Boston	7⅛	6¼	6¼	Jy. 18, Jy. 30		0.25
Calaveras	N. Y. Curb			1⅜			
Calumet & Arizona	New York	81½	72	80⅝	Se. 9, Se. 26	Q	1.50
Calumet & Hecla	Boston	17	16	16⅝	Au. 31, Se.15	Q	0.50
Cerro de Pasco	New York	67⅛	64½	65	Jy.14, Au.1	Q	1.00
Chile Copper	New York	37	35½	36	Se. 2, Se. 30,	Q	0.62½
Con. Coppermines	N. Y. Curb	3¼	2⅞	3			
Copper Range	Boston	17	15½	16½	Ap.2, My.2,	A	1.00
Crystal Copper	BostonCurb	*35	*30	*34			
East Butte	Boston	2	1⅞	1⅞	Dec., 1919		0.50
Granby Consol	New York	37⅜	36	36¼	Jn.15 Jy. 1	Q	1.00
Greene Cananea	New York	79⅛	68⅛	78⅜	Nov., 1920		0.50
Howe Sound	New York	42	38⅜	41⅜	Oc.1, Oc.15,	Q	1.00
Inspiration Consol	New York	19⅛	17⅜	18⅛	Ma.17, Ap.4,	Q	0.25
Iron Cap	Boston Curb	2½	2¼	2¼			
Isle Royale	Boston	13½	12	12¾	Se. 30, Oc. 15,	Q	0.50
Kennecott	New York	76⅜	74	75¼	Se. 2, Oc. 1,	Q	1.25
Magma Copper	New York	45	41	43⅜	Se.30,Oc.15	Q	0.75
Mason Valley	N. Y. Curb	1¼	*80	*80			
Miami Copper	New York	15½	15⅛	15⅜	Au.1, Au.15,	Q	0.37½
Mohawk	Boston	46½	45	45⅞	Jy.30, Se.1	Q	1.00
Mother Lode Coal	New York	2⅜	2¼	2¼	Jn.10, Jn.30		0.25
Nevada Consol	New York	17	16½	16⅜	Se. 16, Se. 30	Q	0.37½
New Cornelia	Boston	22	21½	22	Au.5, Au.22	Q	0.50
Noranda	N. Y. Curb	25	24	24⅜			
North Butte	Boston	1⅜	1	1⅛	Oct., 1918		0.25
Ohio Copper	N. Y. Curb	1⅛	1	1 1/16	Sept. 1926		0.03
Old Dominion	Boston	13½	12½	12⅝	Dec., 1918		1.00
Phelps Dodge	N. Y. Curb			122	Se.21, Oc.1	Q	1.50
Quincy	Boston	18½	17	17½	March, 1920		1.00
Ray Consolidated	New York	15½	15⅜	15⅜	Ap.20, Ap. 30		0.25
St. Mary's Min. Ld.	Boston	24½	22½	23½	Fe.10, Ma.10		2.00
Seneca Copper	New York	1⅜	1¼	1¼			
Shattuck Denn	Boston Curb	5	4⅞	4⅞			
Tenn. C. & C.	New York	9⅛	8⅛	8⅛	Au.31,Se.15,	Q	0.12½
United Verde Ex	N. Y. Curb	25⅛	24¼	24⅛	Oc.6, No.1	Q	0.75
Utah Copper	New York			130	Se. 16, Se. 30	Q	1.50
Utah Metal & T	Boston	1⅛	1	1	Dec., 1917		0.30
Walker Mining	Salt Lake	*52	*51	*51			
NICKEL-COPPER							
Internat. Nickel	New York	72⅞	65½	69⅞	Se. 16, Se. 30	Q	0.50
Internat. Nickel pfd.	New York	108½	108¼	108½	Ap. 14, My. 2	Q	1.50
LEAD							
Gladstone Mtn	Spokane	*15⅛	*14¼	*14¾	June, 1927		0.005
National Lead	New York	128	124	124	Se. 16, Se 30	Q	1.25
National Lead pfd	New York	111½	111½	111½	Se.1, Se. 30	Q	1.75
St. Joseph Lead	New York	40	37	38	De.10,De.20,	QX	0.75
ZINC							
Am. Z. L. & S.	New York	7	7	7	May, 1917		1.00
Am. Z. L. & S. pfd.	New York	37½	36	37½	Nov., 1920		1.50
Butte C. & Z.	New York	4½	4⅜	4⅜	De. 9, De. 24		0.50
Butte & Superior	New York	9½	9	9	Se. 16, Se. 30	Q	0.50
Callahan Zn-Ld	New York	1⅜	1⅜	1⅜	Dec., 1920		0.50
Consol.Lead&Zinc'A'	St. Louis	12½	12⅜	12⅛	Ma.15, Ap.1	Q	0.25
Eagle-Picher	Cincinnati	25⅝	25	25⅛	No 15, De.1	Q	0.40
Eagle-Picher pfd.	Cincinnati			117½	Jn.30, Oc.15	Q	1.50
New Jersey Zn.	N. Y. Curb	188	186	186	Jy.20, Au.10	QX	2.00
United Zinc	N. Y. Curb			*55			
Yellow Pine	Los Angeles			*37½	Dec. 1925	Q	0.04
GOLD							
Alaska Juneau	New York	1⅜	1⅛	1⅛			
Argonaut	Toronto	*55	*40	*42½			
Barry-Hollinger	Toronto	*82	*55	*70½			
Con.W.Dome L.new.	Toronto	*10½	*10	*10½			
Cresson Consol. G.	N. Y. Curb	2	2	2	Se. 30, Oc.10	Q	0.10
Dome Mines	New York	11⅞	8⅛	11	Se.30, Oc.20	Q	0.75
Golden Cycle	Colo.Springs	†1.79	†1.77		Au.30, Se.10	Q	0.04
Hollinger Consol.	Toronto	18.00	17.25	17.30	Se. 21, Oc. 7	F	0.10
Homestake Mining	New York			61½	Se..20, Se. 26	M	0.50
Kirkland Lake	Toronto	2.40	2.20	2.34			
Lake Shore	Toronto	25.75	24.85	25.60	Se.1, Se. 15	X	0.20
McIntyre-Porcupine	New York	27	26⅛	27	Au.1, Se.1	Q	0.25
Portland	Colo.Springs	†*30	†*25		Ap.6, Ap.15,	Q	0.02
Rand Mines	New York			48½	Au.22-29	Am.Sh.	1.52
Teck-Hughes	Toronto	10.00	9.20	9.90	*Jy.21, Au.1		0.10
Tom Reed	Los Angeles	*47½	*42½	*42½	Dec., 1926		0.02
Tough-Oakes	Toronto	*37	*30⅜	*30⅜			
United Eastern	N. Y. Curb			*35	July, 1924		0.05
Vipond Cons	Toronto	*69	*64	*65	Apr.1, Apr.15		0.03
Wright-Hargreaves	Toronto	7.80	7.35	7.75	Jy.15, Au.1	SA	0.05
GOLD AND SILVER							
Carnegie Metals	Pittsburgh			13			
Con. Cortez	N. Y. Curb	*20	*18	*20			
Con. Virginia	San Francisco	*8½	*7½	*7½			
Dolores Esperanza	N. Y. Curb	*60	*50	*60	July, 1923		0.05
Premier Gold	N. Y. Curb	2½	2½	2½	Se. 15, Oc. 4		0.08
Tonopah Belmont	N. Y. Curb	1½	1½	1½	Ma.15, Ap.4		0.08
Tonopah Extension	N. Y. Curb			*51	Apr. 1925		0.05
Tonopah Mining	N. Y. Curb			2½	Ma.31, Apr.21		0.07½
West End Consol	N. Y. Curb			*7	Mar., 1923		0.05
Yukon Gold	N. Y. Curb			*45	June, 1918		0.02
SILVER							
Beaver Consol	Toronto	1.77	1.65	1.75	May, 1920		0.03
Castle-Trethewey	Toronto	*70½	*67½	*70			
Coniagas	Toronto	4.75	4.45	4.75	May, 1924		0.12½
Keeley	Toronto	*79	*75	*79	Se.1, Se.15		0.08
Lorrain Trout Lake	Toronto			*60	July, 1925		0.05
McKinley-Dar.-Sav.	Toronto	*25½	*15½	*22	Oct., 1920		0.03
Mining Corp. Can.	Toronto	3.15	3.05	3.07	Jn. 29, Jy.15		0.12½
Nipissing	N. Y. Curb	7⅛	5⅛	7⅛	Se.30, Oc.20	Q	0.07½

Stock	Exch.	High	Low	Last		Last	Div.
SILVER-LEAD							
Ahumada	New York	5	4½	4½	Ma. 25,Ap.4,	QX	0.12½
Bingham Mines	Boston	55	50	55	Se.24, Oc.5	Q	1.00
BunkerHill&Sullivan	N. Y. Curb	124¾	106½	124¾	Jy. 30, Au.4	X	0.75
Cardiff M. & M.	Salt Lake	*43	*39	*39½	Feb. 5, 1927		0.10
Chief Consol	Salt Lake	2.30	2.30	2.30	Nov., 1926	Q	0.10
Consti'nMng.&Mill'g	Spokane	*20	*17	*18			
Erupcion	Boston Curb	*70	*70	*70	Se. 15, Oc.3	Q	0.07½
Eureka Lily	Salt Lake	1.17½	1.10	1.15			
Federal M. & S.	New York	130	130	130	Jn.25, Jn.29	Spec.	$10
Federal M. & S pfd.	New York			93	Au. 25, Se.15	Q	1.75
Hecla Mining	N. Y. Curb	16	15½	16	Au. 15 Se 15	Q	0.25
Highland-Surprise	Spokane	*11	*10	*10½			
Iron King Mining	Salt Lake	*49	*49	*49			
Keystone Mining	Salt Lake	*20	*20	*20	Au. 12, Au. 26		0.07½
Lucky Jim	Spokane	*27½	*27½	*27½			
Lucky Tiger-Com	Kansas City	†7.00	†6.80		Se.10, Se. 20		0.05
Mammoth Mining	Salt Lake	1.80	1.80	1.80	Jn.10, Jn.20	Q	0.05
Marsh Mines	Spokane	*75	*75	*75			
North Lily	Salt Lake	3.45	3.15	3.15			
Park Utah	New York	7⅛	7⅛	7⅛	Se. 15, Oc. 1	Q	0.20
Plutus Mining	Salt Lake			1.70	Jy. 10, Jy. 15	Q	0.10
Silver King Coal	Salt Lake			8.75	Se. 20, Oc. 1	Q	0.25
Silversmith	Spokane	*19	*17	*18	Oct., 1926	Q	0.02
Strattons Mines	Spokane	*45½	*43	*44½			
Sunshine M. Co.	Spokane	1.40	1.35	1.37			
Tamarack-Custer	Spokane	*25	*21	*24	Sept., 1924		0.25
Tintic Standard	Salt Lake	12.12½	12.12½	12.12½	Se.15, Se.29	QX	0.40
Utah-Apex	Boston	5½	5	5	Oct., 1926		0.25
IRON							
Bethlehem Steel	New York	63½	60½	62½	Se. 2, Oc. 1.		1.75
Cleveland-Cliffs Iron	Cleveland	100	92½	93	Jy. 15, Jy. 25	Q	1.00
Colorado Fuel & Iron	New York	83½	80	82	May, 1921		0.75
Gt. North'n Iron Ore	New York	28⅜	26⅛	27⅛	Dec. 6, Dec. 28		0.75
Inland Steel	New York	51¼	50	50	Au. 15, Se. 1	Q	0.62½
Replogle Steel	New York			12⅛			
Republic I. & S.	New York	66⅛	64½	64½	Au. 15, Se. 1	Q	1.00
Republic I. & S. pfd.	New York	103½	103¼	103¼	Se. 15, Oc. 1	Q	1.75
Sloss-Sheffield S. & I.	New York	126½	126½	126½	Se. 10, Se. 20	Q	1.50
Sloss-Shef. S.&I. pfd.	New York	107	107	107	Se. 20, Oc. 1	Q	1.75
U. S. Steel	New York	157	150½	152⅞	Au. 30, Se. 29	Q	1.75
U. S. Steel, pfd.	New York	136½	135½	136	Au.1, Au. 30	Q	1.75
Virginia I. C. & C.	New York			45	Jan., 1924		1.50
Virginia I.C.&C. pfd.	New York			60½	Ju. 15, Jy. 1		2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN							
De Beers Consol	New York			27½	Jn. 26, Jn.30		1.45
So. Am. G. & P. New.	N. Y. Curb	3½	3⅛	3⅛			
Alum. Co. of Amer.	N. Y. Curb	102	99½	99½			
Alum. Co. of Amer.pf.	N. Y. Curb	103	103	103	Se. 15, Oc. 1	Q	1.50
Vanadium Corp.	New York	54⅜	53⅛	53⅞	Au. 1, Au. 15	Q	0.75
Patino M. & E.	New York	20¼	20	20⅜	Ap. 27, My. 5		1 sh.
ASBESTOS							
Asbestos Corp.	Montreal	30	28¾	29¼	Jan., 1926		1.50
Asbestos Corp. pfd.	Montreal	95	93½	95	Se.30, Oc.15	Q	1.75
SULPHUR							
Freeport, Texas	New York	84	78½	81	Oc.15, No.1	QX	1.50
Texas Gulf	New York	81⅞	72½	77	Ju. 1, Ju. 15	Q	1.00
MINING, SMELTING, REFINING AND GENERAL							
Amer. Metal	New York	44⅞	43	43⅜	Au.20, Se.1	Q	0.75
Amer. Metal, pfd.	New York			110½	Au.22, Se.1	Q	1.75
Amer. Sm. & Ref.	New York	180½	174	177	Jn 8, Au. 1	Q	2.00
Amer. Sm. & Ref. pfd.	New York	130	129	130	Au. 1, Se. 1	Q	1.75
Consol. M. & S.	Montreal	237	232	234	Jn. 30, Jy. 15	X	6.25
Newmont Mining	N. Y. Curb			24⅜	Se.30, Oc.15	Q	1.00
U. S. Sm. R. & M.	New York	43⅜	41	42½	Jy. 6, Jy. 15	Q	0.87½
U.S. Sm. R.&M. pfd.	New York	51	51	51	Jy. 6, Jy. 15	Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED SEPT. 13, 1927 Last Div.

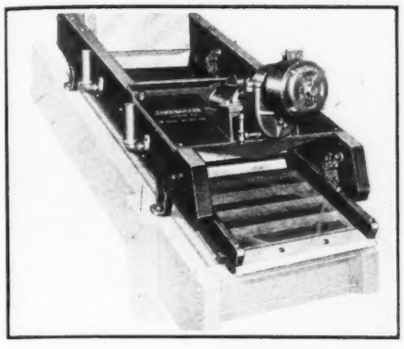
Name	High	Low	Last	Date	Amount
Aramayo Mines (25 frs.)	76/3	73/9	76/3	Aug., 1927	5 p.c. (†)
British Platinum (£1)	1/6	1/3	1/6	Feb., 1925	2½ p.c.
Burma Corpn. (10 rupees)	13 4½	12/9	13/1½	Aug., 1927	6 annas*
Bwana M'Kubwa (5s)	5/1½	4/6	5/—		
Camp Bird (2s)	4/3	3/3	3 9		
El Oro (£1)	3/4½	3/1½	3 4½	Nov., 1924	2½ p.c.*
Esperanza (10s)	—/2	—/2	—/2		
Frontino & Bolivia (£1)	14 7½	13/9	13/9	July, 1927	5 p.c.
Mexican Corpn. (£1)	8/4½	7/—	8/—		
Mexico Mines of El Oro (£1)	15 3	14 —	15/—	Dec., 1926	3½ p.c.*
N'Changa Copper Mining	7 6	7 —	7/6		
Oroville Dredging (£1)	5/—	4 6	4 6	Dec., 1923	¾ p.c.
Ouro Preto (£1)	2/6	2/—	2/6	May, 1925	2½ p.c.
Rhodesian Congo Border (£1)	45/—	41/10½	42/6		
St. John del Rey (£1)	10/6	10 —	10/—	May, 1927	3½ p.c.
San Francisco Mines (10s)	27/6	26 9	27/—	July, 1927	15s.
Santa Gertrudis (£1)	16/4½	15/9	16 3	July, 1927	7½ p.c
Selukwe (2s. 6d.)	8/10½	8/3	8/6	April, 1917	6¼ p.c
S. Amer. Copper (2s.)	2/9	2/4½	2/9	Nov., 1917	75 p.c.
Tanganyika (£1)	64/9	56/6	62 —	Aug., 1927	7½ p.c.
Union Miniere du Haut-Katanga (Brussels)	9.850	9.400	9.650	July, 1927	182.60 (‡)

* Free of British income tax. † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Modern Equipment

U. S. James Designs New Screen

SELLING RIGHTS in the United States, Canada and Mexico to the James screen, a recently developed vibrating screen, have been acquired by the Norwood Engineering Co., of Florence, Mass. The screen was developed by U. S. James, mechanical and metallurgical engineer of Newark, N. J., and is based on what the maker claims is a new principle of vibration.



The new screen is made in both the wet type, shown here, and the dry type

Mr. James originally designed and developed the James screen for sizing ores. A new principle of vibration was necessary to give higher capacity and absolute freedom from blinding. Sectional screens were developed to reduce the expense of replacement of an entire screen when worn in part only, and washing trays were designed to disintegrate the accumulation of mud balls on wet screening. Greater economy, it is claimed, is obtained through the high capacity and long life of the new screen.

The vibrator in the new screen consists of only three moving parts: a gyrating ram weighing more than 30 lb. operates against a heavy piston, which in turn transmits the shock through a small anvil to a wooden cross member connecting the hanger bars which carry the screen frame. This ram gyrates at 300 r.p.m., and each of its six chilled-steel sockets collide with the hardened-steel contact points of the piston, giving to this latter member 1,800 head-on collisions per minute. The repeated shocks transmitted to the screen in this manner do something more than force every possible ounce of material through the meshes—they keep the screen from blinding and give uniform vibration over its entire surface.

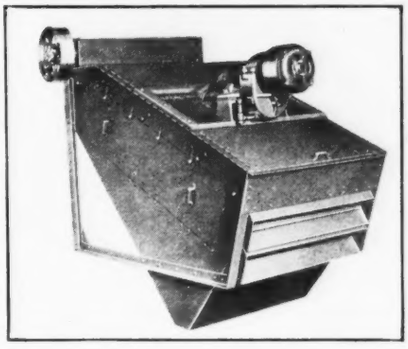
The vibrator is housed in a heavy dust-, dirt-, and water-proof cast-iron casing and requires a change of oil only once in every three or four months. The screen frame is suspended by flexible vanadium-steel hangers, so that neither dust, grit, nor moisture can possibly affect the free movement of the screens.

Screen frames are built in sections, which are interchangeable. Every 6 sq.ft. of screening surface may be removed and replaced under actual working conditions in less than two minutes. The saving on screen cloth is obvious as well as the saving in time.

When screening material that is finer than $\frac{3}{16}$-in. in diameter by the wet process auxiliary washing trays placed every 2 ft. across the screen area serve to disintegrate the accumulation of mud balls. By the addition of sufficient wash water, the fine grains are forced through the meshes with great rapidity. This feature is entirely new and adds from 25 to 50 per cent to screening efficiency.

The screen can be operated by either a 1-hp. motor or from a line shaft. Screens up to 18 ft. in length have been built and are working satisfactorily with the same size of motor, there being the same uniformity of vibration over the screening surface of a large screen as over that of a small one.

The screen is said to have an exceptionally wide screening range and is adaptable for screening everything screenable. The Norwood Engineering Co. builds it in both the wet and the dry types.



The dry screen is housed to minimize dusting

Bag for Carrying Explosives to Working Face

At the suggestion of and in co-operation with several leading mine operators, the du Pont company has developed a powder bag for the economical, safe, and practical carrying of high explosives from storage to the working face. The material used in making the bags is a specially treated fabric which is waterproof and resistant to fungus, dry rot, acid waters, vitiated air, and all similar underground conditions. It is also a non-conductor of electricity.

Experience has shown the risk run by the use of untreated canvas bags and the ever-present danger of the tearing or coming apart of bags when explosives are being carried up raises or otherwise handled in mines, quarries, and construction work. The material used in making the powder bags described is the same as that from which Ventube is made. Two types, pouch and knapsack, are made, and the capacity of the bags varies from 50 to 125 sticks of dynamite.

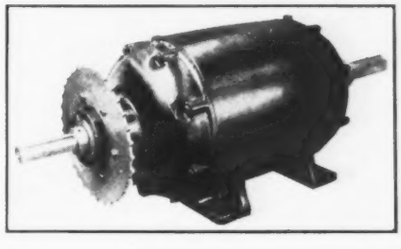
Variable-Speed Transmission Highly Developed

Equipped with speed changers, high-speed motors which are economical to purchase may be used to drive machinery. Variable operating speeds may be obtained over a wide range by incorporating a variable-speed transmission in the drive. A transmission, known as the JFS, to serve this purpose has been developed by the Stephens-Adamson Manufacturing Co., of Aurora, Ill. It is described by the maker as follows:

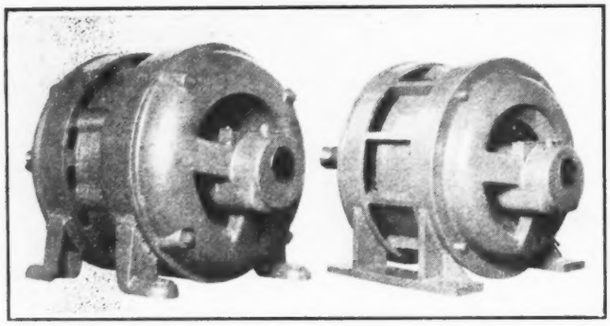
The JFS variable-speed transmission performs the function of receiving power at high speeds and delivering that same power at lower speeds for the direct operation of machinery equipment to which the unit may be attached. The rate of rotation of the low-speed shaft may be decreased or increased over a wide range, under absolute control.

Application of an entirely new principle has resulted in this variable speed-changing device, which operates quietly, efficiently, and without vibration. Here are roller bearings in the new rôle of transmitting power at a variable rate of speed. Actual transmission of power is accomplished through the resulting action of genuine roller bearings revolving in polished races, submerged in oil. The pressures between the rollers and races of transmissions sufficient to transmit their rated horsepowers are only a fraction of the allowable unit pressures common to the usual ball and roller bearing loadings. The hand or sprocket wheel is easily turned to adjust the rate of rotation of the low-speed shaft to any speed within the range.

Variations in speed are made without interruption while the machine is in



A new variable-speed transmission that uses roller bearings to transmit power



These motor frames are built up from hot-rolled steel parts welded together

motion. The machine may be driven in either clockwise or counter-clockwise direction with the same efficient results. The standard variable-speed transmissions are made in sizes to transmit ½ to 15 hp. at the maximum reduction.

There are two distinct series of these machines. The first series provides a reduction of approximately 8 to 1 for the lowest speed. The second series provides a reduction of approximately 40 to 1 for the lowest speed. Each of the series has a variable range of approximately 5 to 1.

New A.C. and D.C. Solenoids

RECENTLY a new line of solenoids has been introduced that includes both alternating and direct current types. It has been designed especially for uniformity and flexibility. These are made in all voltages and frequencies up to and including 550 volts, and nearly all the different types vary from each other in size only. This line is announced by the General Electric Co., and has been given the designation CR-9503.

Each size of solenoid has four types made up with the same frame. This allows any solenoid to be adapted to a variety of applications. An a.c. solenoid can be adapted for d.c. operation by simply changing coils and adding a cutout switch for which all frames are drilled. A pulling solenoid may be changed to a pushing solenoid by adding two standard pusher bars. The pole face of the plunger is cylindrical and fits into a cylindrical seat on the frame This insures quiet operation in any position.

All coils are wound on moulded compound spools, which eliminates the possibility of grounds. Bakelite guides prevent the plunger from wearing the spool body. The coils are held in the correct position by springs which prevent any vibration.

In the d.c. type, one section of the coil is a high-resistance section which is short-circuited by the cutout switch until the stroke is nearly completed. The cutout switch then opens and inserts this winding. No external resistance is necessary.

In cases where power supply is limited, the inrush amperes of the solenoid may cause the voltage to drop because of poor line regulation. Pull values are given for 85 per cent voltages to take care of this condition.

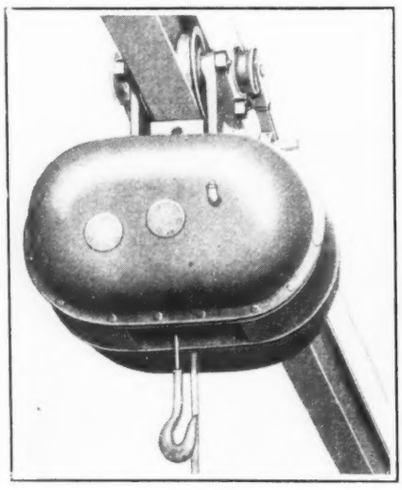
Welded Motor Frame Patented

Recent patents issued from the U. S. Patent Office include welded-steel motor frames in which welded steel construction has replaced castings. Patents 1,629,877 and 1,629,876 were issued to James F. Lincoln and assigned to the Lincoln Electric Co. of Cleveland.

As shown in the accompanying illustration, the construction is an assembly of hot-rolled steel parts welded into the equivalent of a casting. The claims allowed for the method of construction cover its use only to dynamo electric machines. According to the statements of the company's engineers, it is claimed that the welded-steel method of construction gives a practically unbreakable frame, lighter weight, and better ventilation.

A New Quarter-Ton Hoist

At the recent National Machine Tool Builders' Exhibition at Cleveland an interesting all-steel quarter-ton electric hoist was shown for the first time. This was a high-speed hoist with pressed-steel frame, chrome-manganese steel in gears and shafts, ball bearings, non-spinning hoisting rope, oil-bath lubrication, push-button control, and upper and lower limit switches. All working parts were fully inclosed. The hoist weighed 200 lb.



Quarter-ton electric hoist of all-steel construction

The hoist shown at Cleveland is the "Quick-Lift," which is made by the American Engineering Co., of Philadelphia. It may be had in the plain-trolley and hook-suspension types. The former requires 16-in. headroom and the latter 18 in.

A Take-up of New Design

An improved type of take-up has been developed by Link-Belt Co., 300 W. Pershing Road, Chicago, for heavy work and long movement. In construction and design its details are said to conform with sound engineering practice. It is known as Style DS.

According to the manufacturers, the diameters of screws, lengths of bearings, and strength of frames are all correctly proportioned for the size of shaft and length of movement, thus insuring maximum strength with minimum weight and strength. The frame is of welded structural steel with channel base welded to ends formed of steel plates, bent and welded into strong box members, in which the adjusting screw is mounted.

The steel angle bolted on top of the ends protects the screw from dirt or weather. It also ties the ends together, thus strengthening the frame and preventing any upward movement of the bearing. The protected screw remains fixed in position. The nut for adjusting the movement of bearing travels on the screw.

In the design described, the movement-adjusting screw does not project beyond ends of frame or require the additional space and special framing necessary with many other styles of take-ups. The cast-iron bearing is lined with high grade of babbitt, tapped for grease cup or pressure fitting, and is correctly proportioned in length for each diameter of shaft.

CATALOGS

PUMPS — Connersville Blower Co., Connersville, Ind. Bulletin 19E. Cycloidal rotary pumps. Pages 8.

MELTING POTS—General Electric Co., Schenectady, N. Y. Bulletin GEA 164B. Type RP metal-melting pots and equipment for metal-melting pots. Pages 8.

BLOWERS—Connersville Blower Co., Connersville, Ind. Bulletin 10C. Rotary positive blowers. Pages 4.

FURNACES—W. S. Rockwell Co., 50 Church St., New York. Bulletins 280, 281, and 284. Conveyor furnaces for heat-treating and other electric furnaces.

SCREEN—Norwood Engineering Co., 200 Dartmouth St., Boston, Mass. The James vibrating screen. This screen is described on the preceding page.

VALVES — Merco Nordstrom Valve Co., San Francisco. Plug valves for various operations.

FURNACE — Combustion Engineering Corporation, 200 Madison Ave., New York. Catalog FF2. The C-E Fin Furnace. A new edition of the company's Fin Furnace catalog.